Analysis of Stone Tools from Holder-Wright Mound Complex, Dublin, Ohio

A Senior Honors Thesis

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Background

This project seeks to analyze the function of the Holder-Wright mound complex during the Middle Woodland period (100 B.C.-A.D. 400). This was done by mapping spatial distribution of surface artifacts and analyzing these artifacts for attributes relating to the production of stone tools. This was done in an attempt to better understand how the site was used by the mound builders and is lodged in the belief that the distribution of surface artifacts on a plowed surface can accurately reflect the activities of previous times. Another important aspect of the analysis is the measurement of various attributes related to stone tool production exhibited by the collected artifacts. In measuring 21 attributes on these artifacts, a picture of the tool making industry can be formed, showing methods of tool production, stages of production that took place at the site, and quality of workmanship in the flintknapping industry of the area. All of this information, taken together, can help to describe the site more fully rather than just focusing on the mounds, as previous research has tended to do. In understanding the area as a whole, rather than being site or feature specific, more knowledge is to be gained from this important piece of Ohio's past.

The Holder-Wright Site

The Holder-Wright mound complex of Dublin, Ohio is located in a valley of the Scioto River and consists of three earthworks and five burial mounds, created in the Middle Woodland period (100 B.C.-A.D. 400) by people of the Hopewell tradition (Shetrone 1925:341-358). It is currently located on a privately owned farm consisting of four identified areas, Area A, Field B, Area C and Field D.

My research focuses on the two eastern fields with two earthworks, a possible settlement, and one burial located in the north field (Field B) and a south field (Field D) with no associated earthworks (Figure 1). Field B is approximately 123m wide and 200m long. The elevation in the center of the field is 853ft. with a slight drop in elevation as you move southward. The coordinates of the center of the field are 40°06'46.78"N, 83°06'22.78"W. The center of the southern field (Field D) is 846ft in elevation with coordinates of 40°06'39.15"N, 83°06'25.20"W. The elevation drops as you move west, dipping toward the river.

The two eastern fields are separated by a small creek that flows between them. Both fields have been plowed for approximately 150 years but other activities on the fields have differed. Excavations of the mounds and a trench excavation, concentrating mostly on the mound and enclosure in Field B, were completed in the 1920's and 1960's by researchers Henry Shetrone and Raymond Baby, respectively. No formal excavation has been done in Field D. Research by the Smithsonian Institute, the Ohio Historical Society, Shetrone and Baby, however, have all focused on different aspects of the site and create a patchwork of knowledge that must be pieced together (Dancey 1997:14-15). This site is extremely significant not only because of the uniqueness of its mounds but also because it is the northernmost complex of its kind in Ohio (Shetrone 1925:341-358) and due to encroaching housing projects, it is important that a comprehensive study of the Hopewell impact on the area be done.

The Hopewell Tradition

The Hopewell tradition dates from the Middle Woodland period, which ran from 100 B.C.-A.D. 400. Hopewell sites are frequently located along major streams, and extend from northwestern Ohio as far south as Georgia (Dancey 2005:125). Features identified with the Hopewell tradition include “extravagant burial ceremonialism, diversified craft arts, and inter-regional exchange” (Dancey 2005:109). Earthwork mounds and enclosures associated with these mounds, much like those exhibited at Holder-Wright, are a common aspect of Hopewell sites dating from the Middle Woodland period. These mounds are most well known in Ohio, but they extend from New York in the north to southeastern Indiana (Dancey 2005:120). The methods of building, shape and size of these mounds and enclosures vary significantly, but they are often round or square shaped. Burials may or may not be associated with these earthworks. The use of land surrounding these earthworks has yet to be appropriately studied.

Dancey and Pachenco, in their work entitled “A Community Model of Ohio Hopewell Settlement”, enumerate the number of different hyptheses about how the Hopewell settlements have been used. It has been hypothesized by others that the Hopewell had nucleated communities and lived in villages, were semi-sedentary, and seasonally occupied permanent settlements, and it has also been suggested that they were a fully mobile group (Dancey 1997:3). It is currently believed that settlements were permanent and related to earthworks although much more research needs to be done to support this. However the area was settled, there is always stone tool debris associated with Hopewell sites.

The material used in stone tool production was obtained both through trade and from more local sources. Well-known quarries of the Hopewell are located in Ohio’s Flint Ridge, southern Indiana, southern Illinois, Missouri, and North Dakota. Stone types coming from these areas include Vanport flint, Wyandot chert, Cobden chert, Burlington chert, and Knife River chalcedony (Dancey 2005:116-117). Debris from Hopewell sites usually consists of “nodular and pebble hammerstones, antler flakers, biface drills, probable biface knives, uniface flake scrapers, utilized flake (unmodified) knives, ungrooved groundstone and copper axes, abrading stones, bone awls of several types, beaver incisor chisels or knives, copper and meteoric iron awls or drills (rare), and eyed bone needles” as well as cooking pebbles (Fischer 1974:44-45). A number of these items were found at the Holder-Wright site.

Stone Tools

Production of many of the artifacts in the assemblage requires expert working of flint and other stones in order to create a finished piece. This working involves taking the cortex, or weathered surface off of the rock and flaking it in a way that creates the desired form. It begins with removing large flakes and ends with very small, thin flakes. The tools used in the flaking process may also change with hard stones being used initially and softer antler being used for the finishing flakes. Tools can also be reused and resharpened, which may change their shape. Stone tools were used throughout history by a number of people, including the Hopewell. Hopewell tools are usually well made and show expert precision in the flaking. Knowing the shape and features of a particular tool, especially projectile points, is important in distinguishing what group made the tool and when it was created

Methodology

Surface Survey

Collection of artifacts from the Holder-Wright site was completed during the spring of 2004 over a period of four weeks. The method of collection was a surface survey with lines marked out west-east along Field B and north-south along Field D, spaced 1m apart. Collectors consisted of undergraduate students from Dr. William Dancey's Archaeological Field Methods class, of which I was a part. Students walked down their assigned line and flagged each artifact they saw on the surface. The flagged artifacts were screened by Dr. Dancey prior to collecting and measuring the location of each, although due to the inexperience of the collectors, many natural, unworked pieces of flint were collected.

Location of artifacts was measured using a Topcon model GTS 211D total station survey instrument (a tripod mounted computer which projects laser beams to a prism and records the amount of time it takes for the laser to reflect back to the instrument) which triangulates the location and gives northing and easting measurements from the fixed point of the instrument. The datum used was from approximately the center of Field B on the west side. The coordinates of the datum were 500E, 550N. Readings from the Topcon were handwritten at the site. At the time of recording artifact locations, the artifacts were also bagged and taken back to the lab where student volunteers washed each piece. I then labeled each of the 1142 artifacts with the accession number X39 and sequential catalog numbers.

Flint Types

The types of flint (also referred to as chert) used in tool production and scattered across a site can tell a lot about the people who lived in or used the area. Different flint types occur in different locations, and by identifying the type, you can track the movement or trade practices of a group. Outcrops of various flint types occur throughout Ohio (Figure 2) as well most of northeastern America, stretching up to Canada.

Bisher chert is a Silurian deposit found ranging from Hillsboro, Ohio to Highland and Adams Counties (Figure 3). The colors of this chert vary from white to yellow including tans and creams (Figure 4). Heat-treating the chert may produce pink or mauve coloring. According to Allen, the texture is grainy and the chert is of low quality (Allen 2006) although Kagelmacher states that the texture and quality can range "from sub-porcellaneous, grainy material to homogenous, porcellaneous material of good quality" (Kagelmacher 2001:41). Presence of Bisher chert in the Holder-Wright assemblage was fairly low, with only 5% (n= 32) of the sample being rough or sandy in texture (Figure 5).

Onondaga chert occurs in outcrops ranging from Ontario, Canada to Orange County in New York to the west (Allen 2006), although it is often identified in artifact assemblages from northern Ohio (Figure 6) (Kagelmacher 2001:62). Colors range from dark to very dark gray with some greenish gray. Mottling of darker colors, blue/gray or white can also be seen (Figure 7). Patination may be white or brownish yellow (Kagelmacher 2001:63). This is a Devonian age chert of high quality with no macroscopically visible fossils and a porcellaneous texture (Kagelmacher 2001:62). Onondaga chert in the Holder-Wright assemblage represents possibly up to 10% (n= 109) of the entire sample (represented by a solid black color, (Figure 8) with 13% (n= 58) of the Field B population and 8% (n= 51) of the Field D population. This type of chert occurs in every artifact type in varying proportions.

Another dark colored chert present in the Holder-Wright collection is Boggs chert. It occurs in Perry, Licking, Muskingum, Coshocton and Tuscarawas counties of

Ohio and is of Pennsylvanian origin (Figure 9). The dark gray to black coloration prevails with numerous light colored to white fossils contained within (Figure 10 and 11) (Kagelmacher 2001:70).

Lower Mercer chert is a Pennsylvanian chert very similar in appearance to Boggs, Zaleski, and some Upper Mercer cherts. It occurs from Mahoning County in Pennsylvania through Ohio and into Kentucky. The black material often has a waxy luster and is of slightly better quality than Boggs chert. Bluish gray coloration, and some drusy quartz are common (Figure 12 and 13). Fractures of this chert tend to be coarse with sharp edges (Kagelmacher 2001:73-76).

Upper Mercer chert can range in colors with both light and dark varieties (Figure 14). They are excellent quality and are waxy to porcellaneous. Multicolored mottling is common with dark brown to brownish yellow weathering (Figure 15). Upper Mercer is also a Pennsylvanian chert with the black samples resembling Lower Mercer cherts. Upper Mercer occurs throughout the state of Ohio with large deposits in both northern and southern Ohio.

Flint Ridge Flint is one of the most common flints to be used in Hopewell industries throughout Ohio (Figure 16). “Archaeologically, Flint Ridge flint (also known as Vanport flint) is one of the best known and most widely distributed lithic raw materials in eastern North America. This is due, in large measure, to the prodigious efforts of Hopewellian groups in quarrying this high-quality and colorful flint and circulating artifacts crafted from it across much of the midcontinent” (Lepper et al 2001:1). Carlson characterized four varieties of Flint Ridge flint:

1. "milky white or bluish white with light-gray patches and streaks" (Carlson 1987:15)

2. "highly colored variety with its intricate combinations of red, yellow, brown, blue, and green" (Carlson 1987:15);

3. "dark gray to black" variety (Carlson 1987:15);

4. "ribbon flint alternating dark and light-gray layers" (Carlson 1987:67)

Flint types 1 and 2 occur in and around Flint Ridge State Memorial. Type number 3 comes from Musgingum County, and the fourth type occurs on the western and southeastern sections of Flint Ridge (Yerkes 1995:3)

Flint Ridge Nethers, or Carlson's "ribbon flint" (Figure 17) was identified in the Holder-Wright assemblage (Figure 18), but only representing a few individuals. This flint is of high quality and comes from Licking County, Ohio (Allen 2006).

The presence of a number of different types of flint at the Holder-Wright mound complex suggests that trading was quite possibly very important for the people using the site. Many of the flint types identified in the Holder-Wright assemblage come from areas other than central Ohio. It is also possible that these flints were being mined in other places and brought to the Holder-Wright area to be processed.

Artifact Types

Identification of each artifact followed labeling. Identifications of projectile point type and flint type used in the production of the artifacts were also made. Projectile point analysis is important to know because it tells what group made the point and when it was created. Flint type analysis tells whether there are rocks from other locations at the site, which can suggest trade or mobility. Artifact identification can distinguish what types of industry were going on at the site. For the artifact type analysis, collected artifacts were grouped into one artifact type from the following, according to the listed criteria:

1) Core- any lithic that exhibits three or more flake scars, occurring on more than one side but is not shaped
2) Uniface- any lithic with purposeful human flaking on a single side (usually dorsal)
3) Biface Blank- a lithic flaked on both sides with some shaping but remaining cortex
4) Biface Preform- a lithic being flaked on both sides and all cortex removed; flaking has created shaping of the desired form
5) Biface- a completed tool with both sides flaked, all cortex removed, and a functional form
6) Projectile Point- a completed biface tool with worked edges and a point at the tip, which also usually contains a means of hafting to a shaft
7) Shatter- angular debris from initial flaking that exhibits some evidence of human manufacture
8) Complete Flake- a flake that retains a striking platform and the distal termination
9) Proximal Flake- a flake that retains the striking platform but does not have the maximum length of the termination
10) Medial Flake- a flake that has neither the striking platform or any evidence of distal termination
11) Distal Flake- a flake that shows the form of distal termination but does not exhibit the striking platform

12) Other Flake- a flake that has been broken down the length so that only one side remains; may exhibit striking platform, distal termination or both

13) Indeterminate- part of a flake that has no identifiable features as to what part of the flake it is

14) Natural- any rock that exhibits no evidence of human working, such as flaking or burning

For the first approximately 200 pieces, my identifications were reviewed by Dr. William Dancey prior to being accepted. The remaining identifications were done by myself , with help given when needed on unusual pieces. All identifications were put into an Excel database that contains the field number and catalog number of each piece in the assemblage, the raw location data, x,y coordinates for the mapping program, all 21 attributes that were later measured, and whether or not a picture of that artifact was taken.

Artifact Attributes

The attributes measured and included in the Holder-Wright database are all aspects present on flakes and stone tools that are related to flintknapping activity. Some are qualitative measurements, identifying aspects of the flint itself while others are quantitative. Following is a list of all attributes that were measured and the tools used in the measurement.

1) Burning- presence of burning due to crazing or pot lidding, measured visually

2) Lustre- shininess or dullness of the lithic, measured visually

3) Texture- roughness or smoothness of the lithic, measured visually and tactilely

4) Color- color of the lithic, measured visually

5) Cortex- percentage of outer weathered surface remaining on lithic, measured visually

6) Striking platform- presence of a platform on proximal end of flake, identified visually

7) Striking platform width- measure of striking platform from the left side to the right side along the top of the flake, measured by digital sliding caliper

8) Striking platform thickness- measure of striking platform thickness from dorsal to ventral side on a flake, measured with digital sliding caliper

9) Striking platform preparation- presence of flake scars on the dorsal side of the striking platform, identified visually

10) Striking Platform lip- a lip on the ventral side of the striking platform, identified visually

11) Striking Platform Angle- the angle of the striking platform on the dorsal side of a flake, measured with cardboard notched at known angles

12) Bulb of Percussion- presence of a bulge just under the striking platform on ventral side of flakes, identified visually

13) Bulb of percussion width- distance across a flake that the bulb of percussion spans, measured with digital sliding caliper

14) Bulb of percussion thickness- max thickness of bulb of percussion from dorsal to ventral side of a flake, measured with digital sliding caliper

15) Dorsal scars- number of flake scars apparent on the dorsal side of a flake, identified visually

16) Dorsal arris- a line extending the length of a flake on the dorsal side created by the intersection of flake scars, identified visually

17) Length- maximum distance from striking platform to termination of distal end, measured by digital sliding caliper

18) Width-maximum width from side to side, measured by digital sliding caliper

19) Thickness- maximum thickness measured from dorsal to ventral surface, measured by digital sliding caliper

20) Weight- measured by scientific scale

21) Plowing effects- presence of damage due to the effects of plowing, identified visually

Attributes of the lithics were graphed individually and together with similar attributes to further describe the stages of production as well as correlations between attributes and artifact types or rock types.

Analysis

Identification of the artifacts from the Holder-Wright assemblage resulted in the occurrences shown in Table 1. Each artifact type will now be described in detail with broken down percentages of each artifact type reported for Field B and Field D.

Core

For the purposes of this project, a core was defined as any lithic that had three or more identifiable flake scars occurring on more than one side, but was not intentionally shaped or flaked on the edges (Figure 19). The flake scars had to show the attributes of being man-made, thus having ripples, a bulbar scar, evidence of a platform or platform preparation.

A core is the main rock from which flakes are struck. Cores can assume distinctive shapes according to what type of flake is desired. For blade flakes, the cores will often be conical in shape where pieces are detached in a single direction from one flat surface or striking platform, but there were no blades or blade cores evident in the Holder-Wright collection. Cores can also be multidirectional, or amorphous, where there is more than one striking platform that flakes are taken from in multiple directions (Andrefsky 1998:137).

Cores make up 5% (n= 24) of Field B and 4% (n= 28) of Field D with an overall percentage of 5% (n= 51).

Uniface

A uniface is characterized by intentional and purposeful flaking on one side of the lithic, usually the dorsal side (Figure 20). Edge preparation is the key to identifying a uniface. Many flakes have dorsal scars, but they usually appear to be random and are not worked on the edge of a flake. Unifaces have edge preparation as well as a uniform order to the flaking on one side. Unifaces can be general or classified as a scraper. On scrapers, flaking is more concentrated on one edge, thus producing a sharp scraping edge. General unifaces may have edgework on more than one side or may just have purposeful flaking of the dorsal side.

Uniface occurrence in Field B was 2% (n= 11) and in Field D, 1% (n= 11) making the percentage in the entire sample 2% (n= 22).

Biface Blank

A biface blank is characterized by flaking from both sides of the lithic with remaining cortex on the outer surface (Figure 21). Thus, a biface blank represents the second stage in biface or projectile point production. This occurs when flaking has taken place on both sides of the lithic with purpose towards the creation of a tool, but production was stopped before all outer cortex of the stone was removed. A biface blank "must have the morphological potential to be modified into more than one implement type within the assemblage" (Bradley 1975:5), which means that the shape is usually undefined at this point. This mid-production abandonment of a biface blank could occur because the stone is of low quality or has imperfections which result in an undesired flaking pattern or breakage. It could also be due to the inexperience of the tool producer, or something as simple as the tool producer finding a better job to do and forgetting about the blank.

Biface Blanks represent 5% (n= 23) of the artifacts from Field B and 7% (n= 48) of artifacts from Field D with an overall representation in the entire sample of 6% (n= 71). Fragments make up 2% (n= 24) while the remaining 4% (n= 45) are complete or nearly complete samples.

Biface Preform

Biface preforms represent the stage in biface or projectile point production immediately after the biface blank stage. During this stage, the goal is to thin and regularize the lithic, thus producing the desired form (Whittaker 1994:156). Biface preforms are lithics which have been flaked on both sides resulting in all cortex being removed from the lithic. Bruce Bradley describes a preform as “any piece of lithic material that has been modified to an intended stage of a lithic reduction sequence in a specified assemblage” (Bradley 1994:6). It must, however be clear that it is not a finished tool and that it is intended for further modification (Bradley 1994:6). Often, a shape can be discerned from the biface preform, suggesting its function, but the final tool has not been completed. Typical bifacial tools include projectile points, drills, adzes, and generic bifaces (Odell 2004:65), although only generic bifaces and projectile points were identified in the Holder-Wright assemblage. A biface preform is the abandonment of tool production at the last stage, right before the tool has been completed. Abandonment could be due to any of the reasons stated above under biface blank abandonment. Also, preforms were often stored or traded to be made into a tool at a later time.

In field B, the percentage of Biface preforms is 1% (n= 4) while in Field D it represents less that 1% (n= 3). The total percentage in the entire collection is 1% (n= 7) with most being fragments.

Projectile Point

A projectile point represents the finished product of stone tool production. It has a definite shape, bifacial reduction, and no remaining cortex (Figure 22) . There are many different shapes and sizes of projectile points, determined by the culture creating them and the time when they were made. Points from the Middle Woodlands period can be notched or not, and be used for arrows or for spears, depending on shape. There is a great variety in the types of projectile points found at Hopewell sites throughout the Midwest and this site follows the pattern, with many different styles of points.

Projectile points were not common at the Holder-Wright site, representing 1% (n= 6) of lithics from Field B and less than 1% (n= 5) from Field D, with a total representation of 1% (n= 11) in the entire collection. This may signify that there was very little tool completion at the site, or it could be a factor of many collectors taking the projectile points from the site over hundreds of years.

Projectile point types present can tell about trade and time frame of site occupation. Although there were few recovered projectile points, the points fall into a few different categories which can distinguish their makers.

Based on their style, most points from the Holder-Wright assemblage date from the Late Archaic period, prior to the Middle Woodland period. It is difficult to classify these points into specific type categories because they are mostly unfinished preforms (incomplete points) or broken points. However, one point was identified as a Trimble type point, which is a common point dating from the Late Archaic. The presence of these points suggest that the site was important to other groups even before the Hopewell used it as a ceremonial and burial center.

Interestingly, there were no points dating from the Middle Woodland period in the collected material from Holder-Wright. This could be due to the fact that Middle Woodland points are finely crafted and tend to be collectable. The area has been collected by farmers and amateurs for hundreds of years; therefore the number of Hopewell points on the surface is likely to be much less than other, less collectable points.

A projectile point dating from the Late Woodland or Late Prehistoric period, after the Hopewell occupation of the site is the Hamilton Incurvate point. These are found throughout the south from Tennessee to Ohio (Justice 1987:226-229). Presence of up to three of these points tells us that there was also occupation at the Holder-Wright site after the Hopewell mounds were constructed and used by the Hopewell. From the information provided by these projectile point type identifications, it becomes apparent that the site was used over a long period of time by many different groups.

Shatter

Shatter is the by-product of stone tool flaking. It is removed from the core as flakes are being taken off. Usually, shatter is of an angular shape because of the trajectories affecting its breaking (Figure 23). Shatter can be due to the use of excessive force in striking, or impurities or cracks in the core. It is thought that most shatter occurs in the early stages of toolmaking when large flakes are being removed. Reduction stage, therefore, is reflected in percentages of shatter present in a sample in relation to complete and incomplete flakes (Kooyman 2000:54). The debitage from secondary flaking would usually be too small to recognize as shatter. Shatter can be identified by its angular shape and possible flake scars running across it. For this study, flaked lithics that could not be assigned to another class and showed evidence of burning were categorized as shatter. This may increase the percentages of shatter from the site.

Field B was 9% (n= 42) shatter while Field D was 6% (n= 39) shatter, making it 7% (n= 81) of the whole collection. Intensive core reduction is characterized by a shatter percentage of approximately 20% with cores at 15% and complete flakes at 50% (Kooyman 2000:54). The data from the sample seems to follow this trend with shatter at a higher percentage than cores when naturals are removed from the equation (shatter=15% (n= 81), cores=10% (n= 52)) and complete flakes at 75% (n= 407) for the whole site.

Both field B and D follow the same trend as the overall with shatter percentages being higher than core percentages. Field B has 23% (n= 42) and 14% (n= 24) respectively (Chart 1) and Field D has 11% (n= 39) shatter to 8% (n= 28) cores (Chart 2). This suggests that, at least in the first stage of tool production, there was intensive flaking done on cores.

Complete Flake

For the purposes of this research, a complete flake was defined as a flake with a discernable striking platform as well as evidence of the flake termination. The termination had to be complete in that a reasonable measure of length for the original flake could be made.

Complete flakes are successful flakes that do not break when being taken off a core, although the terminations are useful in measuring how successful the flaking really was. There are four possible terminations for a flake, representing different situations for each. Six terminations were identified in the Holder-Wright collection because I made a distinction between hinge fractures showing evidence of feathering or stepping at the end and true feathers. Each of these is discussed below.

Termination types that were identified in the assemblage are: feather, hinge, snap/step, feather/hinge, feather/step and outrépassé. Feather fractures are the intended fracture, where the distal end of the flake becomes thinner and thinner as you approach the base (Kooyman 2000:19). A feather fracture is achieved by applying the right amount of force onto the striking platform at the correct angle.

Hinge fractures occur when the direction of force is deflected towards the outside of the core (Odell 2004:57). It results in the distal end of the flake rolling out to the core surface in a rounded fashion (Kooyman 2000:19). In other words, “the fracture plane, normal on the proximal end, turns abruptly up at the distal end, away from the center of the core” (Tixier 1974:15)

Step fractures, also called snaps often occur because of impurities or cracks in the rock itself. Lateral snap fractures are also “associated with high tensile stresses and occur perpendicular to stress” (Hayden 1979:84). The cause is “complete dissipation of energy or by intersection with an impurity” (Odell 2004:58) in the rock. They result in the distal end of the flake ending in a right angle. Snaps can also be caused by pressure from plows, but an attempt was made to distinguish new snap scars from weathered snap flake terminations.

The distinction feather/hinge was a category created to fit flakes that had significant feathering but also included slight hinging. The feather/step category included flakes with both a feather and a right angle at the distal end. It was believed that these flakes did not fit completely into either category since they exhibit qualities of both. Due to differing fracture mechanics working on each termination, I feel that these two groups represent a unique situation and should be distinguished.

An outrépassé flake continues to the end of the core and bends around the opposite surface (Kooyman 2000:19). Outré passé is also known as an overshot, and it indicates an error in the manufacture process (Odell 2004:121). According to Whittaker, overshot flakes occur if “you make a platform too strong or too close to the centerplane” of the objective piece. Bending stresses also influence outré passé fractures (Whittaker 1994:165).

Complete flakes make up the largest percentage of lithic types, representing 24% (n= 110) of the sample in Field B and 43% (n= 297) of Field D. The overall percentage of complete flakes is 36% (n= 407). Therefore, complete flakes make up a little over 1/3 of the material scattered on the surface of the fields.

Feather terminations represent the highest frequency terminations, making up 72% (n= 122) of Field B complete and distal terminations and 80% (n= 333) of Field D complete and distal flake terminations (Chart 3 and 4). Outrépassé flakes make up the smallest number of flakes, only representing 1% (n= 6) of the entire assemblage. There seems to be little difference in the terminations represented by the two fields.

There is also little difference between complete flake termination types and distal flake termination types. The largest difference is that 81% (n= 152) of distal flakes have feather terminations and only 71% (n= 121) of complete flakes have feather terminations. This could be an indication of post-depositional factors such as plowing breaking a complete flake and creating the distal flakes rather than distal flakes being produced by improper flaking.

Proximal Flake

A proximal flake is a flake that does not have evidence of the termination point but does have an intact striking platform. Proximal flakes can still give important information about the production stage of the flake (primary, secondary, ect.) as well as how the flake was formed. It may include a bulb of percussion, bulbar scar, a platform lip, platform preparation, and the angle of the platform.

Proximal flakes have a lower occurrence than complete flakes with 13% (n= 60) and 9% (n= 60) in Field B and Field D respectively. This makes the average of 10% (n= 120) of the sample proximal flakes.

Medial Flake

A medial flake contains neither a striking platform nor evidence of the flake termination. Medial flakes are usually the central part of the flake and provide little information about the flaking process. Both sides of the flake must be intact or evident for a flake to be categorized as medial. Information gained form these flakes usually does not go beyond identification of dorsal scars and width of the flake.

Medial flakes were not as common as other types of flakes with 5% (n= 21) of Field B and 4% (n= 29) of Field D, making the overall occurrence 4% (n= 50).

Distal Flake

Distal flakes represent the opposite of proximal flakes. These flakes have a complete, or significant portion of the termination but do not have a striking platform. Distal flakes can represent a nearly complete flake in the situation where the striking platform alone has shattered off. They may also represent only the lower part of the termination. Distal flakes often do not provide as much information as proximal flakes but sometimes by using dorsal scars you can tell if it is primary or secondary flaking, as well as if the flaking was successful if the termination is a feather.

Fourteen percent (n= 62) of the sample from Field B is made up of distal flakes while 18% (n= 124) of Field D is distal flakes. This makes the overall 16% (n= 186).

Other Flake

The category of “other flake” was created for flakes representing one side of a flake. Sometimes heavy striking or impurities in the rock can cause the flake to break in half straight through the middle, with half or none of the striking platform remaining, and the termination at the bottom evident. This category was created because the midline breaking pattern is evident of overzealous striking power, and thus it can tell about the flaking process.

The category of other flake was the least represented of all flake types with 2% (n= 11) of Field B and 3% (n= 23) of Field D, making the total 3% (n= 34) of the collected population.

Indeterminate

Lithics were identified as indeterminate if it was apparent that they were part of a flake, but it could not be determined what part of the flake the piece came from. This could be a medial flake with one or both sides missing, a plow damaged flake which had lost its proximal and distal features, or a severely burnt lithic where the proximal and distal features were indistinguishable. The lithic must exhibit some feature of a flake such as a bulb of percussion, rippling, or flake scars.

Indeterminates make up 1% (n= 6) of Field B and less than 1% (n= 1)of Field D, making up less than 1% (n= 7) of the total.

Natural

Due to the fact that the collecting group was inexperienced with lithics, many natural pieces of flint were collected. These pieces of flint exhibit no evidence of human use, including flake scars, burning, striking platforms, ripples, ect. Each piece, however was recorded, numbered, and measured for comparative purposes. Having no visible marks of human use also does not mean that the piece was not traded from another area, which could mean that it was affected by human use. Therefore, in determining origins of each flint type, the naturals are included.

Because Field B was the first field collected, there is a much higher percentage of naturals in this sample. Sixteen percent (n= 72) of all lithics collected from Field B are natural. In Field D, this number is reduced to 2% (n= 12) with the increased experience of the collectors. The overall representation of natural flints in the collection is 7% (n= 84).

Attributes

The 21 attributes of each collected artifact that were measured are indicative of how the rock was worked into tools and how the rock may have been used. Many of these attributes are only present on flakes, suck as striking platforms or distal terminations, and others may occur on all lithics, such as burning. These attributes give differing amounts of information about the lithic and have different amounts of inter-observer bias. For example, lustre and texture are quite subjective measures, and cannot always be trusted.

Burning

Burning, or heat treating of rock, especially flint, results in a distinctive crazing or pitting of the surface of the rock. This crazing can take over the entire stone or only parts of it (Figure 24). The “pot lid” effect can also be seen where round fragments are popped out of the rock, creating circular pits of varying size. No other process creates these rounded pits and so it is indicative of heat treatment or burning. Heat treatment can also result in the exterior of the heat treated flint appearing dull while the interior becomes smooth with a greasy or waxy lustre and feel (Kooyman 2000:65).

Both crazing and the pot lid effect were evident in the Holder-Wright collection. For most lithic types, burning was only seen in 10% of the population. A higher percentage (17% (n= 2) and 37% (n= 30) was seen in projectile points and shatter respectively. The higher number of burnt projectile points could be due to the small number of points found in the sample, or the heat treating of high quality stones which finished projectile points were made of. The high percentage of burnt shatter is due to the identification methods used. Pieces of crazed rock that could not be identified as a specific artifact type were placed into the category of shatter. This was done in an attempt to keep these pieces within the groupings of human-modified artifacts.

Only definite evidence of crazing or pitting was used as a determinate for heat treating. Waxy luster or dull exterior were not used as qualifying factors.

When examining the data, it became apparent that a trend is seen in the types of rock that were burnt. This trend seems to favor darker colored rocks, particularly black, for burning while very few of the lighter colored lithics were burnt. Black rocks maintain a percentage of 57.8% (n= 63) being burnt with varieties of black (black with blue, brownish black, black and white) having 50% or more burnt. Three other colors have higher percentages of burning than black, but this is due to the small number of lithics representing these colors. For light gray, which represents 56% (n= 627) of all lithics in the sample, only 4.6% (n= 31) of the lithics were burnt.

Lustre

The lustre of a lithic refers to the visible shine or dullness of the surface. Lustre can be influenced by heat treatment with heat treated flints often appearing greasy on flaked portions while unflaked areas appear dull (Kooyman 2000:65). Knowing if specimens are heat treated is important because heat treating can significantly reduce undesirable fractures when flaking, however, lustre is not a definite sign of heat treatment and may be distinguished differently by different people.

Lustre in Field B is 84% (n= 383) shiny or waxy with 16% (n= 74) dull. Field D has significantly less dull material with only 3% (n= 20) of the lithics appearing dull throughout. Possibly then, more heat treated material was being used in Field D. This would mean that higher quality tools would be produced here in comparison with Field B. The large number of shiny lustre lithics may also be a result of the method of measurement. Because the measure of lustre is visual, and many flints contain shiny quartz crystals, shininess was generously assigned. Lustre, therefore, is not the best measure of burning.

When looking at lustre versus the distal termination in flakes, a significant majority of feather termination flakes, or successful flakes, do appear shiny or waxy with only 6% (n= 29) appearing dull.

Texture

Texture relates to the type of rock the artifact is made of. Different types of flint have various textures. Texture can also change with heat treatment. "When heat-treatment works, the stone usually becomes less grainy and smoother in texture" (Whittaker 1994:72). Texture alone, however, does not give much information about the lithic. The measurement of texture was done according to geological standards with ratings according to feel and visual cues. If grains could be identified and the feel was rough, then it was identified as sandy. If it was rough to the touch but individual grains were too small to distinguish, it was labeled rough (the geological term for this texture would be silty).

Textures of the two fields of Holder-Wright are very similar with most (94% (n= 430) for Field B and 97% (n= 665) for Field D) being smooth. Waxy texture was also recorded in the sample but in very small amounts. Waxy texture may be die to the effects of burning.

Color

Color is also specifically tied to rock type. Many flints from different areas exhibit colors or patterns that are distinctive to an area or flint type. Heating may also affect color by making it brighter and reddening the rock due to iron oxidation (Whittaker 1994:73).

There was a wide range of colors in the Holder-Wright assemblage, suggesting that many different lithic materials are represented. The most common color in both fields is light gray with 45% (n= 203) of Field B and 63% (n= 424) of Field D being this color. The colors used in Charts 5 and 6 attempt to recreate the colors of the lithics.

As noted before, there is a trend in the color of lithics and their likelihood of being burned, with darker lithics having a much higher rate of burning. Color also seems to be somewhat correlated to the type of artifact that is made out of the stone with a number of projectile points being of pink color and unifaces and cores restricted to a few colors while flakes tend to be a wide range of colors. This could reflect the numbers of each type of lithic in the sample, with cores, projectile points and unifaces represented with very few individuals while flakes make up the largest portion of the assemblage. Nonetheless, it is interesting to see the trends of colors for each artifact type.

Cortex

Cortex is the outer, weathered surface of the rock. The significance of the presence of cortex is that it shows the level of decortification, or flaking, that the core has experienced. The more cortex on a flake, the more likely it is to be a primary decortification flake (Odell 2004:12). “The cortex or weathered exteriors of stone flakes should decrease sharply following initial reduction stages” (Martin and Magne 1989:17) because the initial purpose of flaking is to remove the cortex. Therefore, if there is no cortex present on a flake, it is likely that this flake was taken off in the later stages of tool production where all cortex had been removed.

Cortex percentages for complete flakes show the expected unimodal distribution with most flakes having 0% cortex coverage. This pattern is also shown in each field (Chart 7 and 8).

Striking Platform

The striking platform on a lithic represents the point of impact when the flake was struck off the core. This usually manifests itself as a flat area or a dimple on the proximal end of the flake (Figure 25). Striking platforms are present on complete flakes and proximal flakes. The size and shape of the striking platform is affected by the type of hammer being used to strike with as well as the reduction stage of the lithic, although "platform size appears to be related more to mechanical parameters" (Amick and Mauldin 1989:67).

There are a number of significant attributes of the striking platform that can be measured including exterior (dorsal) angle, preparation, lipping, width and thickness. In Mauldin and Amick's testing, platform width and thickness exhibited a correlation coefficient of 0.83 in a sample of 637 artifacts, showing a significant correlation between the variables. Also in this study, they found that complete flakes tend to have larger platform ratios with a mean of 3.3 and a mode of 4 while incomplete flakes exhibit a mean of 3 and mode of 3, suggesting that the platform ratio may in part determine a successful flake (Amick and Mauldin 1989:81). Results from the Holder-Wright assemblage show a complete flake average ratio of width to thickness of 1.9 with a mode of 2 while the incomplete flakes have a ratio mean of 2.09 with a mode of 2. This does not support the model proposed by Amick.

Graphing of platform width and thickness in each artifact class (complete flake (Chart 9 and 10) and proximal flake (Chart 11 and 12)) show a fairly unimodal curve peaking at about 2mm. This trend is followed by all the graphs, supporting the modal distributions for both complete and proximal flakes discussed above.

Striking Platform Preparation

Striking platform preparation takes place on the dorsal side of a flake, just under the striking platform. The preparation is often described as facets, and the number of facets present can distinguish between a core and bifacial reduction flake. Bifacial platforms have more facets because they require more preparation than a simple core flake due to the fact that biface reduction represents the third step in tool manufacture (Odell 2004:126). Therefore, platform preparation increases as reduction progresses (Amick and Mauldin 1989:17). For the purposes of this research, it suffices to identify whether or not flakes have platform preparation without counting facets for each of the flakes. Counting facets is a long and difficult task, and distinguishes little more than the presence of preparation itself.

There is a high amount of platform preparation represented in the Holder-Wright assemblage. For Field B, 64% (n=110) of the proximal and complete flakes exhibit some type of preparation. In Field D, 51% (n= 184) of proximal and complete flakes have striking platform preparation. This makes the average preparation for the entire site 55% (n= 294) which means that a little over half of the flakes exhibiting platforms are at least secondary flakes. Interestingly, the trend between the two fields in striking platform preparation is opposite the trend in weight, height, length and thickness. According to the results from the platform preparation data, Field B has slightly more flakes at the secondary phase of tool production and beyond. The weight, length, width and thickness data, however, suggests that since Field D flakes are consistently smaller, these should be further along in tool production. One explanation for this would be that since only platform preparation presence or non-presence was recorded, it can only tell that the flake is past the primary flaking phase. It is quite possible that more flakes from the final stages of production are represented in Field D and the high proportion of platform preparation in Field B may represent more secondary flaking instead of final stages. The differences between the two fields are nonetheless quite small and should only be viewed as small trends in the data.

Striking Platform Lip

Striking platform lipping is a protrusion of the striking platform on the ventral side of a flake (Figure 25). It is produced by a bending force and is usually not associated with a bulb of percussion because it is not a true Hertzian force (Kooyman 2000:82). “Soft hammers frequently produce flakes with small bulbs or no bulb at all and a lipping or protrusion of the edge of the striking platform over its contact with the ventral surface” (Odell 2004:59). In fact, according to Whittaker, the most characteristic trait of soft hammer usage in flaking is the lipping of a platform (Whittaker 1994:187).

Lipping often occurs on biface thinning flakes because soft hammers are ideal for this type of thin flake. Bulbs of percussion, if present on these flakes will be small and rather diffuse while the lip protrudes between the platform and the bulb (Whittaker 1994:185).

Platform lips occur in the Holder-Wright assemblage at a mean platform angle of 67.4° with a mode of 70°. Lip presence in Field B consists of 31% (n= 51) of complete and proximal flakes with 4% (n= 7) being slight. Field D only has platform lipping on 19% (n= 67) of proximal and complete flakes with 6% (n= 20) presenting only slight lipping .

Proximal flakes from the two fields show a slightly higher incidence of platform lipping with 30% (n= 35) lipped, 6% (n= 7) of those being slight, as opposed to complete flakes with 21% (n= 84) lipping with 5% (n= 20) of those being slight.

Striking Platform Angle

Striking platform angle refers to the angle created by the striking platform relative to the dorsal side of the flake. This angle can greatly affect flake termination because it reflects the angle of force delivered upon the flake. Dibble and Whittaker matched three platform angles with preference for three specific terminations. For feather terminations, a mean of 41.8° was found with a standard deviation of 9.8. For hinge fractures, the mean angle was 61.5° with standard deviation of , and for outrépassé terminations, the mean angle measurement was 76.7° with standard deviation of 9.4 (Dibble and Whittaker 1981:287-288).

The Holder-Wright data presents a very different distribution than Dibble and Whittaker's. For feather terminations, the mean angle resulted in 71.8° with a sample size of 308. Hinge terminations had a mean angle of 72.1° with a sample size of 60. There were only five examples of outrépassé end terminations which had a mean platform angle of 65°. Hinge and feather termination results for Holder-Wright are significantly larger than those by Dibble and Whittaker while the outrépassé results are much lower. The outrépassé inaccuracies can be explained by small sample size, but the hinge and feather results seem to be in a league of their own.

Even after placing all angles that were over 85° at only 90° (when many of them were much larger than 90° but could not be measured with the apparatus being used), the results are much larger than expected. In bifacial reduction flakes and thinning flakes from bifaces, Kooyman estimates the exterior platform angle to range from 35-65° (Kooyman 2000:51), although all but the few outrépassé flakes fall out of this range..

Exterior platform angle can also give information about the flaking force applied to a flake. “The more acute the core or tool edge (exterior platform angle), the more likely it is that the initiation of the fracture will be due to bending rather than Hertzian mechanisms” (Kooyman 2000:82). Further, if the angle is non-acute, it can only be produced by a soft hammer, such as antler or bone because a hard hammer would automatically produce a Hertzian fracture pattern if making a non-acute angled platform (Kooyman 2000:83).

The sample from Holder-Wright seems to follow the pattern set out by Kooyman, with an increased bulb of percussion occurrence on platform angles up to 70° for Field B (Chart 13) and 80° for Field D (Chart 14). After 70° and 80° respectively, however, the bulbar occurrence drops. This may be due to the presence of lipping as well as the number of flakes in each category.

The actual platform angle trends seem to follow the bulb of percussion appearance, which lends support to the fact that the drop-off of bulb appearance after 70° and 80° for the two fields may be due to a lack of flakes representing these angle measurements (Chart 15 and 16).

Bulb of Percussion

A bulb of percussion is part of a Hertzian fracture and is evident on the proximal end of flakes, beginning just under the striking platform (Odell 2004:55). Bulbs manifest themselves as bulges in the rock, on the ventral surface of the flake which protrude outward with varying intensity. Bulbs may turn into ripples further down the flake, or they may end with the single bulge (Figure 26). They are formed only if the striking platform is large enough and the contact zone is away from the edge of the platform (Hayden 1974:102). Width and height of a bulb varies according to how the flake was struck. Generally, bulbs formed by pressure flaking appear more diffuse and flatter than those produced by percussion (Hayden 1974:102). Analysis of the overall population exhibiting bulbs of percussion shows that most were created by percussion. To analyze this, the ratio of bulb width to bulb thickness was taken and graphed. The higher numbers (4-7) represent a higher likelihood of pressure flaking while smaller numbers (1-3) represent a likelihood of percussion flaking (Chart 17).

The presence of bulbs of percussion was measured from complete and proximal flakes showing that bulbs were present in 62% (n= 344) of the total population with 2% (n= 12) of these being slight. Twenty-seven percent (n= 154) of the complete and proximal flakes had no bulb and 11% (n= 64) had a bulbar scar. These proportions are mirrored in both fields.

Dorsal Scars

Dorsal scars are flake scars present on the dorsal surface of a flake. "Dorsal scar count increases through the reduction process" (Amick and Mauldin 1989:17) because as more flakes are taken off, the scars of previous flakes will be apparent on the dorsal side of the newer flakes. Brian Kooyman proposes production stages based on the number of dorsal scars present on a flake with 0-1 scars representing the early stage of core reduction, two scars being mid-stage shaping and reduction and three or more scars being late stage finishing reduction (Kooyman 2000:54). Although much can be learned from counting the dorsal scars on a flake, it is difficult to assign an objective number to how many flake scars are required before a certain stage of production is met. In my opinion, it is better to look at the entire sample and compare dorsal scar counts within the assemblage to create a relative comparison of reduction stage.

The data on dorsal scarring from the Holder-Wright assemblage seems to follow the trend shown in weight, length, width and thickness of flakes with slightly more flakes in Field D showing evidence of further stages of production (Chart 18). In Field B, most flakes have two dorsal scars (Chart 19) while in Field D, the highest number of flakes have three dorsal scars.

Dorsal Arris

A dorsal arris is a visible ridge on the dorsal side of a flake which runs the length of the flake (Figure 27). This ridge is formed by the intersection of flake scars (Kooyman 2000:14). According to Kooyman, flakes with a dorsal arris tend to be narrower because the arris provides a free surface close to the striking point which ends the lateral stress, thus fracturing the flake at this point (Kooyman 2000:23).

Complete flakes from the Holder-Wright assemblage exhibit a slightly smaller average width of 21.4 mm (mode 15) for flakes with a dorsal arris versus those with no arris, which have an average width of 23.1 mm (mode 21.3). Arris occurrence on complete flakes is 90% (n= 365). Eighty-eight percent (n= 164) of distal flakes and 82% (n= 97) of proximal flakes exhibit a dorsal arris. The slightly lesser number of proximal flakes could be de to the difficulty in identifying an arris on the proximal end of a flake.

Weight

Weight is claimed by Odell to be the most reproducible measurement in regard to lithics (Odell 2004:126). This is because many other measurements of lithics entail finding a beginning and ending point for the measurement, such as length and width, or identifying somewhat subjective features that require knowledge about lithic flaking methods. Weight, however, does not require previous knowledge to measure and is a good approximation of overall size.

Weight distribution in the entire Holder-Wright assemblage follows the typical unimodal curve in both fields (Chart 20 and 21) with the maximum number of specimens in the 0-5 g range.

For complete flakes, a weight curve was also graphed (Chart 22 and 23), showing the same large peak at 1-5 g but, especially in Field B, having quite a few smaller spikes after the significant drop at 5 g. These smaller spikes could represent different types of flakes, which tend to get smaller as the decortification and shaping process of cores continues. Also, Field D has slightly smaller weights that Field B overall, which suggests that there are more flakes in later production stages within Field D, compared to Field B.

Length

Maximum length was measured for every collected lithic and artifact in the Holder-Wright assemblage, including natural stones that were collected. For flakes, maximum length was measured on the ventral side from the striking platform to the furthest tip of the distal end. For non-flake artifacts and natural stones, maximum length was measured as if they were a flake if they resembled the shape of a flake. If the lithic did not resemble a flake, the lithic was turned so that the label was right side up and readable, and the maximum height on a line perpendicular to the label was measured. All subsequent measurements (e.g. width and thickness) were taken in relation to the length measurement alignment.

Length is most significant in complete flakes where the true maximum length can be identified. Although measurements were taken for all other lithic types, graphing was done only for complete flakes.

Both Field B and Field D have a major length peak around 21-23mm (Chart 24 and 25). This is the highest peak for Field B while Field D has higher peaks at both 17 and 25mm. Tapering off occurs after these peaks with multiple smaller peaks on either side. These smaller peaks, as in the smaller peaks in the weight measurements, may represent different distinct stages in core preparation with larger flakes being taken off early in the decortification process and smaller shaping flakes being removed in the later stages of tool production. There seems to be a trend in the Holder-Wright assemblage for a multitude of middle stage flakes and a fair number of small, late stage flakes with very few large, early stage flakes. This trend occurs in both Field B and Field D, with Field D representing slightly more small flakes than Field B. This is shown in both the weight and flake length data.

Width

Width, like length, was measured as the maximum width perpendicular to the length measurement along the ventral side of flakes. In the case of non-flakes, width again, was measured perpendicular to the length measurement on the same side that the length measurement was taken.

Width measurements in complete flakes from the Holder-Wright site mirror the data from both weight and length. Field B width peaks at 18 mm with smaller peaks surrounding on either side (Chart 26). Field D width peaks from 15-20 mm with smaller peaks surrounding (Chart 27). Field D represents slightly smaller flakes than Field D, which also shows smaller peaks at fairly large widths.

Thickness

Thickness was measured again as a maximum for each artifact in the assemblage. Whereas length and width were taken in the x, y plane along the ventral part a flake, the thickness measurement was taken along the z-axis, measuring the 3-dimensionality of the lithic. Thickness was measured parallel to width and perpendicular in the z plane to the length measurement.

The thickness measurements, when graphed, show a slightly more unimodal curve than width, length, and weight. Both Field B and Field D peak at 6 mm thickness but the Field B peak (Chart 28) extends further than Field D's very thin peak (Chart 29). Once again, Field B represents slightly larger flakes compared to Field D.

Plowing Effects

Plowing effects are caused on rock from the movement of a plow over the rock and the resulting damage created by the weight of the plow or contact between disturbed rocks. This can result in breakage, scratching, and chipping of the stone. The most common forms of plow damage seen in lithic assemblages are pressure snaps from the weight of the machine, v-shaped notches (Figure 28), rust stains and unidirectional chipping in a distinct saw edge pattern (Odell 2004:71). Plow damage can be distinguished from human chipping by several factors. First, chips made by a plow are unidirectional in nature. They do not follow the patterning that bifacial flaking creates on a lithic. Also, plow damage often does not create a bulb of percussion or a distinct striking platform. One of the most distinguishable features of plowing damage, however, is the fact that it will be a fresh break. Fresh breaks often appear darker in color than old, weathered breaks and can be easily separated.

Generally speaking, larger objects are more prone to plow damage because they are more likely to be hit by a plow or other hard objects being churned up by the plow due to their larger surface area. Smaller objects are less likely to be hit as well as less likely to be snapped by a plow because they have less surface area for the plow pressure to work on. Therefore, an expected distribution for plow damage on objects, in this case lithics, from a plowed field would be a progressive, upward moving curve where damage increases as size increases.

For the purposes of this study, size was represented by weight in the measure of plow damage by size. All collected lithics were broken into weight groups and percentages of lithics in each weight category that exhibited plowing damage were graphed for each field.

The results of graphing show a near typical upward curve for Field B, with an increasing incidence of plow effects on heavier lithics (Chart 30). The curve is not smooth, as expected, but has many peaks and valleys, and a decrease in plow damage at the highest weight level. The decrease in the percentage of damaged material from the highest weight class could be due to the fact that there were very few lithics representing this weight class. The small number of lithics from this category could skew the percentage to a lower number.

For the second field (D), a much different picture is shown by the percentage of plow effects by weight. After 4 g, the upward curve turns into a variation of large peaks and valleys, representing an approximate average of 40% damaged material up until the 40-50 g-weight class, where the percentage drops to zero (Chart 31).

The low percentages of damage seen in the higher weight classes is again due to a small number of lithics representing each class, with only 4, 4, 1 and 5 individuals representing each of the last four weight classes respectively.

When looking at overall plow effects for each field, we see a slight difference in the percentages of damaged material coming from the two fields. Field B has a lower overall percentage of affected material, with 76% (n= 346) of the lithics having no damage. Field D shows a percentage of 30% (n= 202) damaged material, leaving only 70% (n= 468) undamaged. The higher percentage of damaged material in Field D could be due to the rockier nature of the soil in that area.

Distribution Analysis

Mapping of each artifact recovered from the surface survey of Holder-Wright was done using the computer mapping software Surfer™. Locations for each artifact were recorded during the survey using a total station Topcon system to triangulate the position with the fixed coordinate of the total station's position, or the datum. Mapping of the overall artifact scatter of Field B shows no distinct correlation with the location of the square enclosure and burial, although the scatter area centers around the location of the enclosure with artifact distribution dropping off farther from the enclosure. On the northeast and southeast ends of the field, there were no recovered artifacts. Figure 29 shows the map of all recovered artifacts from Field B with the field oriented as it is in real space. Figure 30 shows the artifact distribution in relation to the square enclosure and burial located on the field.

Separate mapping of each artifact type identified in Field B also shows seemingly random scatter. There are no identifiable activity centers for initial stone tool production, final tool production or stone tool use. Also, the lithic types recovered show no association with the burial and enclosure.

Field D has no associated enclosure and was not surveyed in its entirety. Mapping of artifacts from Field D, however, again shows no specific activity sites but scatter throughout the area (Figure 31 and 32).

Conclusions and Discussion

Given the results of flint type analysis, mapping and analysis of each recovered artifact from the Holder-Wright site, a number of conclusions can be made about the way the site has been used. The fact that various types of flint from areas north and east of central Ohio are represented in the sample provides likely evidence of trade occurring at the site. However, because these lithic types are from the north, they could be glacial gravel, brought by the last glaciers to cross Ohio. The trade hypothesis is at least supported by the presence of different projectile point types which are known from different also helps the theory that trade was an important source of both lithics and finished tools.

Projectile point types present at the site also suggest that this area was used extensively both before and after the building of the mounds in the Middle Woodland period. Mapping of artifact distribution across the Holder-Wright site suggests an extended use of the site after the building of the earthworks. The fact that there is no clustering of artifacts associated with the burial and enclosure in Field B shows that this site was used for more than just the earthworks.

As far as identifiable activity centers within the Holder-Wright site are concerned, mapping shows no evidence of this. Analysis of the individual artifacts seems to point towards Field D being used for more late stage tool production or tool retouch while Field B was used for more primary flaking. This difference, however is not very strong and may be due to differing amounts of artifacts found in each field. Also, it is possible that, with the experience gained by the collectors after the first field, they were able to collect smaller flakes in the second field. These smaller flakes are more likely to represent late stage tool production and the differential experience may be enough to skew the results. A significant change in collecting patterns can be seen in the percentages of naturals collected in each field, so it is likely that, with more experience, smaller flakes would be seen later in the collection process.

This research presents the Holder-Wright site as an activity center with lithic tool production used by Native Americans from the Archaic period through the Late Prehistoric period (2000 B.C.- A.D. 1500) with significant use as a ritual and burial center in the Middle Woodland period by people of the Hopewell tradition. No specific activity centers are located on the site and there is little evidence of a significant tool industry with final tools being rare. Much more research needs to be done to determine how this area was used, however. The south end of Field B should be analyzed for further evidence of settlement and excavation should supplement the data from the surface survey. It is important to not break up the site into the contemporary fields but to consider the area as a whole. Much of the site is inaccessible to study because it has been developed, but it is important to consider that the area used by the Hopewell was not site, and certainly not field specific but covered the surrounding area of Holder-Wright.

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Appendix A-Figures

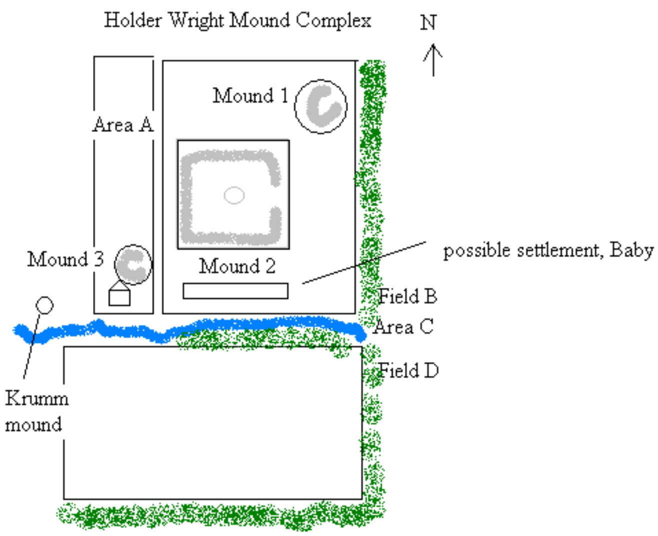

Figure 1-Holder-Wright

Figure 2- Ohio Flint distributions, 2001, ML Kagelmacher,

Figure 3-Silurian Flints in Ohio, 2001, ML Kagelmacher

Figure 4- Bisher chert, 2001, M.L. Kagelmacher

Figure 5- Bisher chert

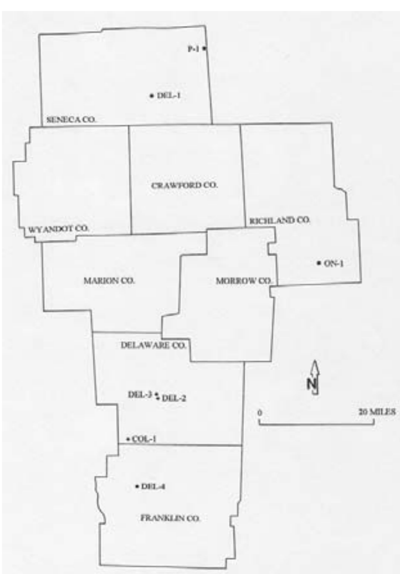

Figure 6-Devonian chert occurrence, 2001, ML Kagelmacher

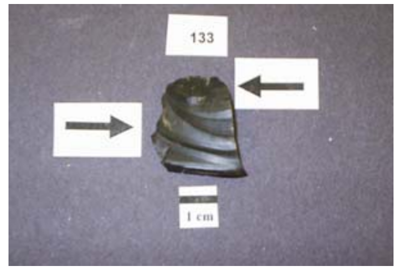

Figure 7-Onondaga chert, 2001, M.L. Kagelmacher   Figure 8- Onondaga chert

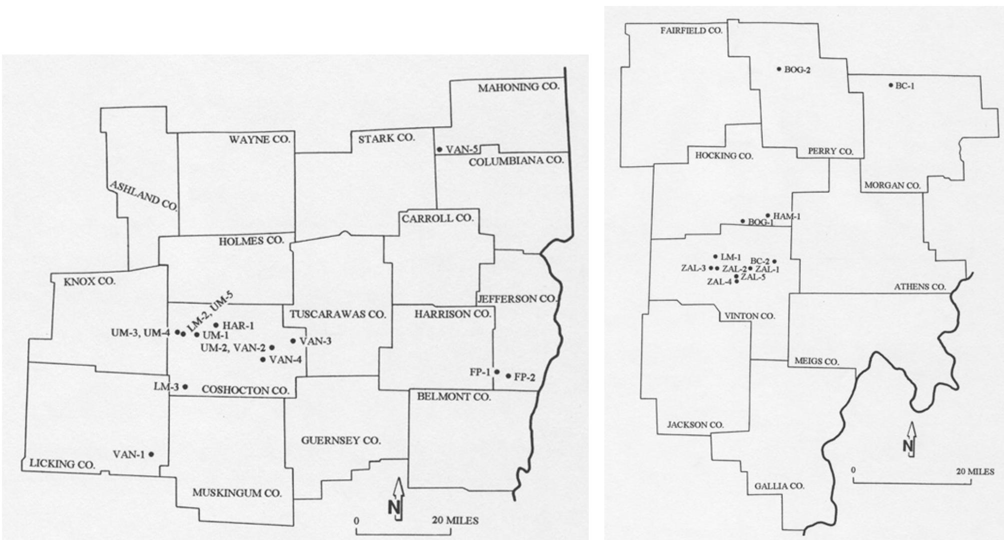

Figure 9- Pennsylvanian chert occurrence, 2001, ML Kagelmacher

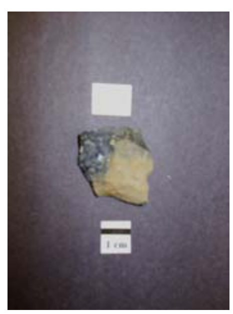

Figure 10- Boggs chert, 2001, M.L. Kagelmacher   Figure 11- Boggs chert

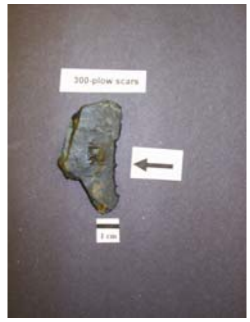

Figure 12- Lower Mercer flint, 2001, M.L. Kagelmacher

Figure 13- Lower Mercer flint

Figure 14- Upper Mercer flint, 2001, M.L. Kagelmacher

Figure 15- Upper Mercer flint

Figure 16- Confirmed Ohio flint, http://www.ohiohistorycentral.org/entry.php?rec=1361, 2006.

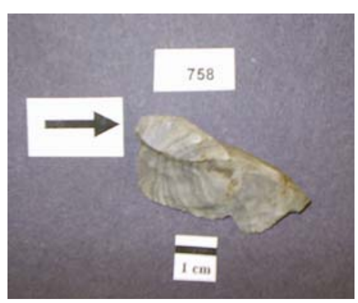

Figure 17-Flint ridge nethers, http://www.theaaca.com/lithnics/flintnethers.htm, 2006

Figure 18- Flint ridge nethers

Figure 19-Core

Figure 20- Uniface

Figure 21-Biface Blank

Figure 22- Projectile Point

Figure 23- Shatter

Figure 24- Burning

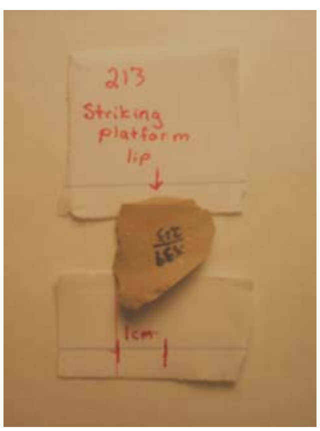

Figure 25-Striking platform and lip

Figure 26-Bulb of percussion

Figure 27-Dorsal arris

Figure 28-Notch plow damage

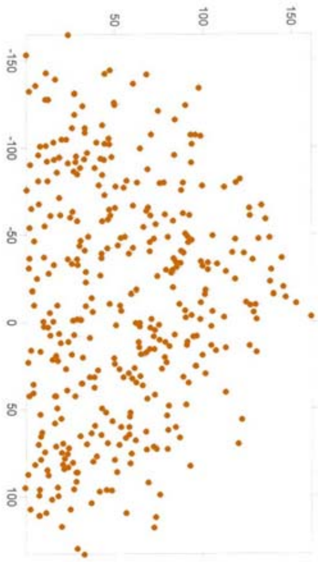

Figure 29-Field B artifact map

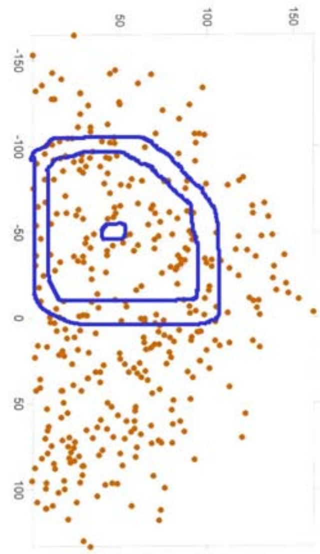

Figure 30-Field B artifact map with earthwork

Figure 31-Field D artifact map

Figure 32-Field D complete flake map

Appendix B- Charts

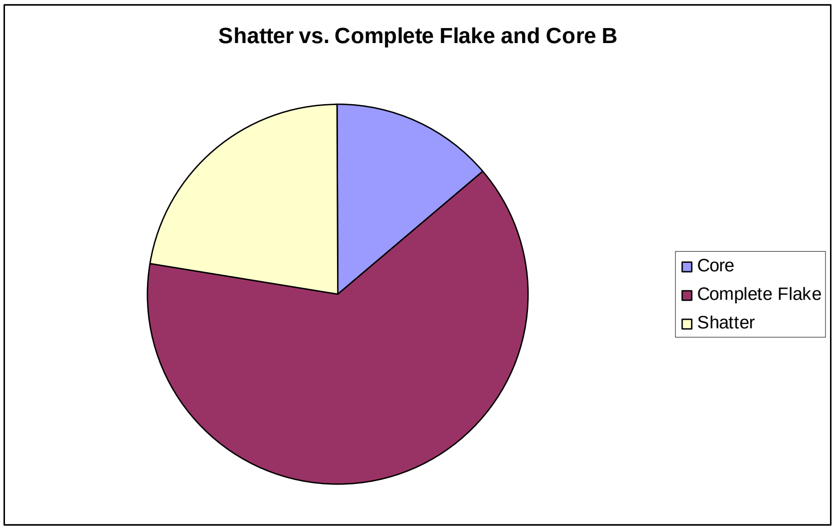

Chart 1- Shatter vs. complete flake and core B

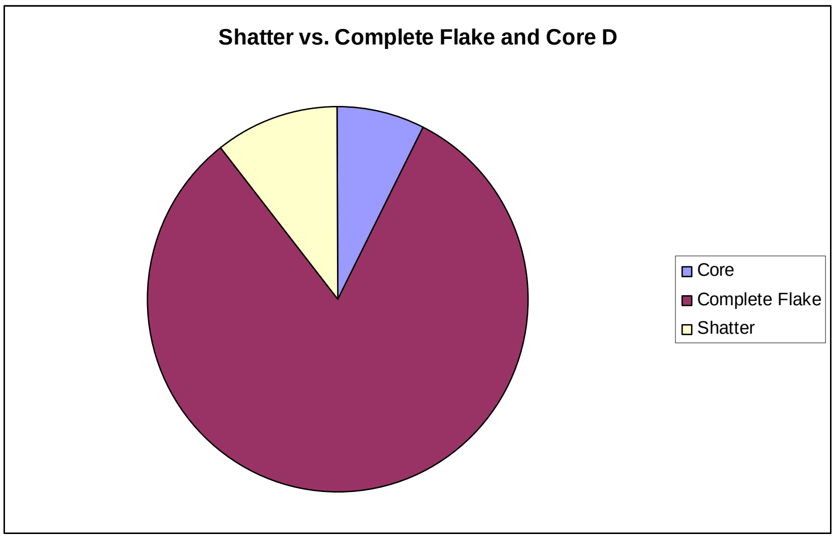

Chart 2- Shatter vs. complete flake and core D

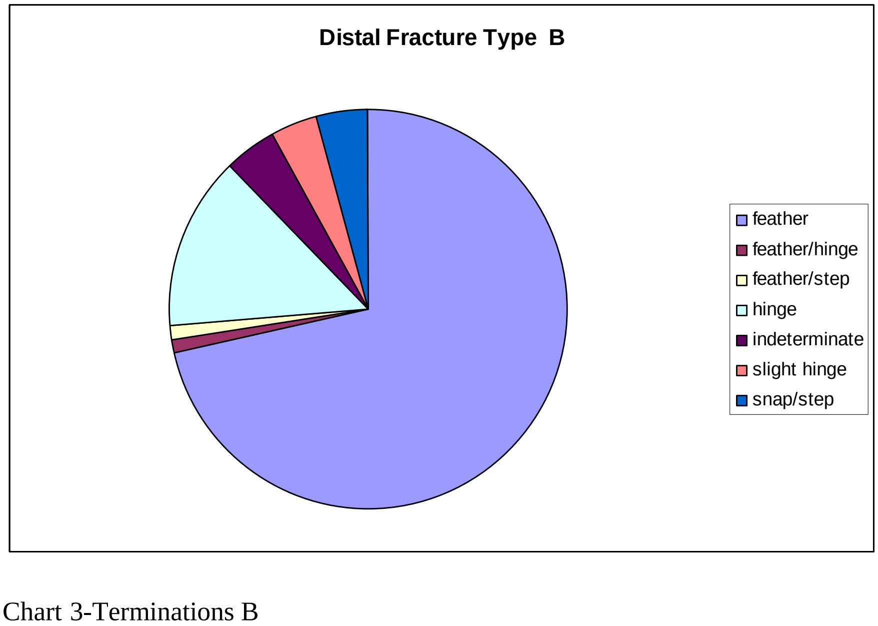

Chart 3-Terminations B

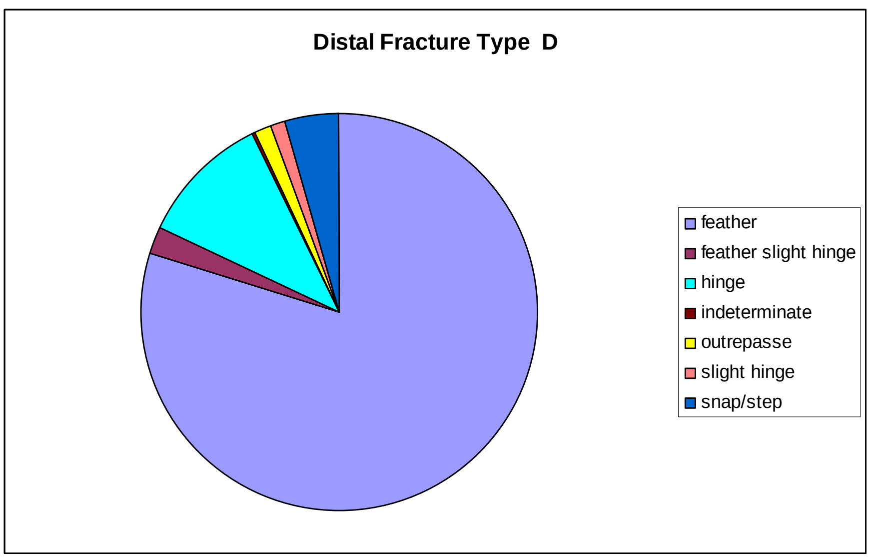

Chart 4-Terminations D

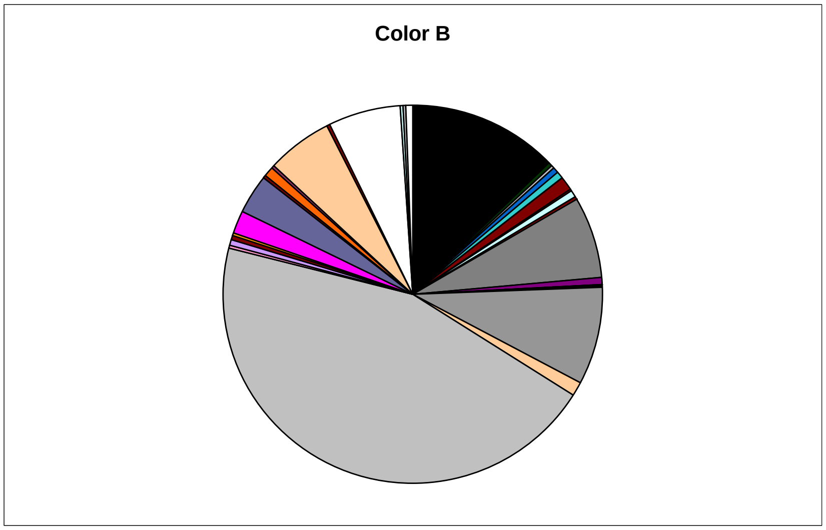

Chart 5-Color Field B

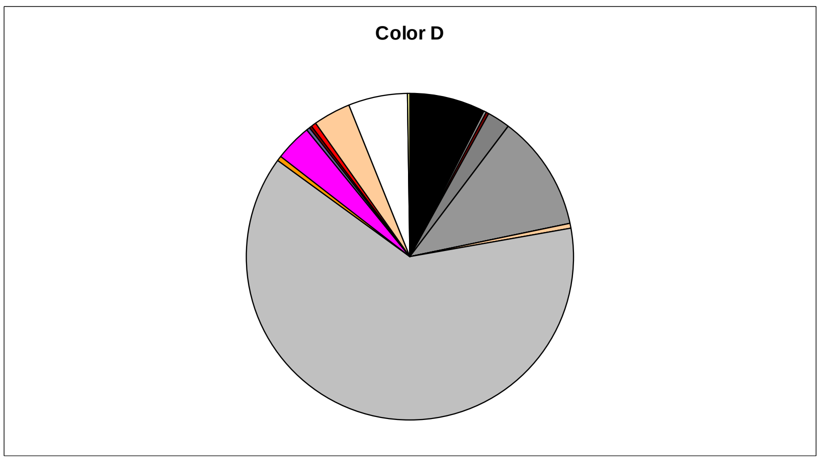

Chart 6-Color Field D

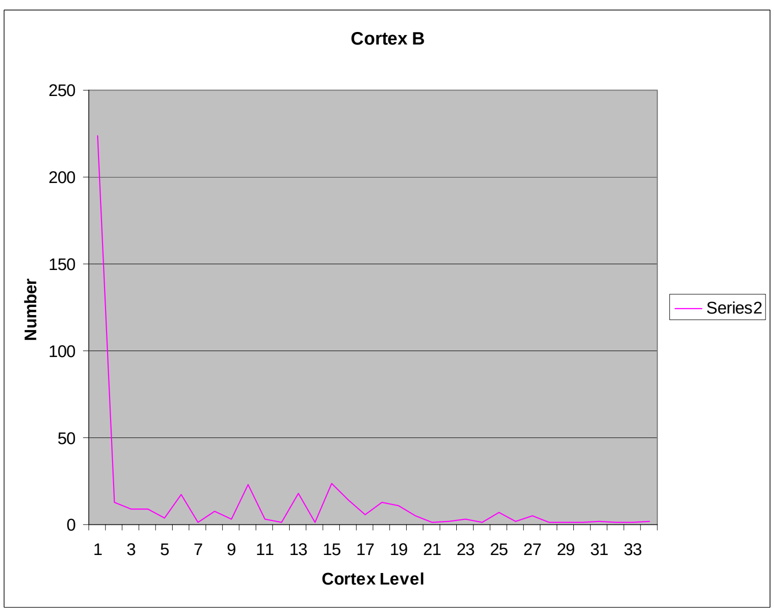

Chart 7-Percent cortex B

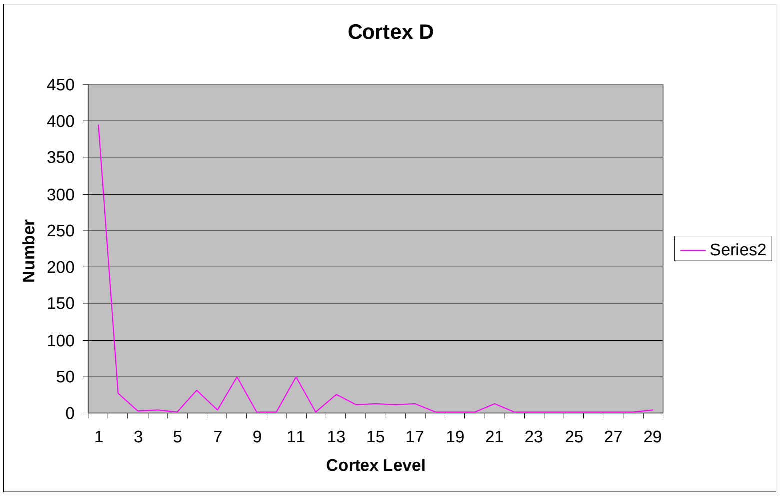

Chart 8-Percent cortex D

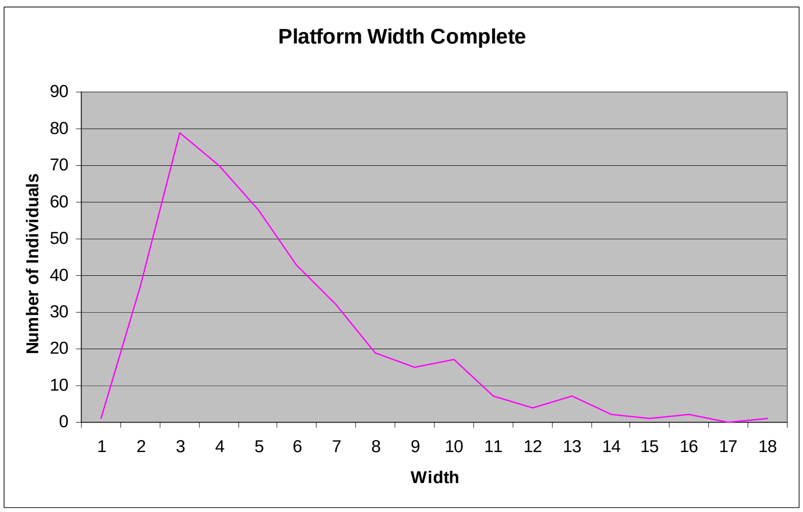

Chart 9-Platform width complete flake

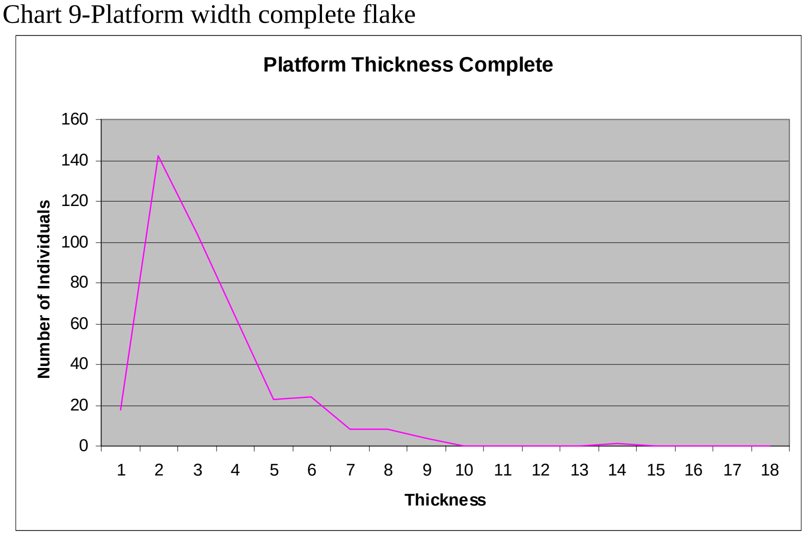

Chart 10-Platform thickness complete flake

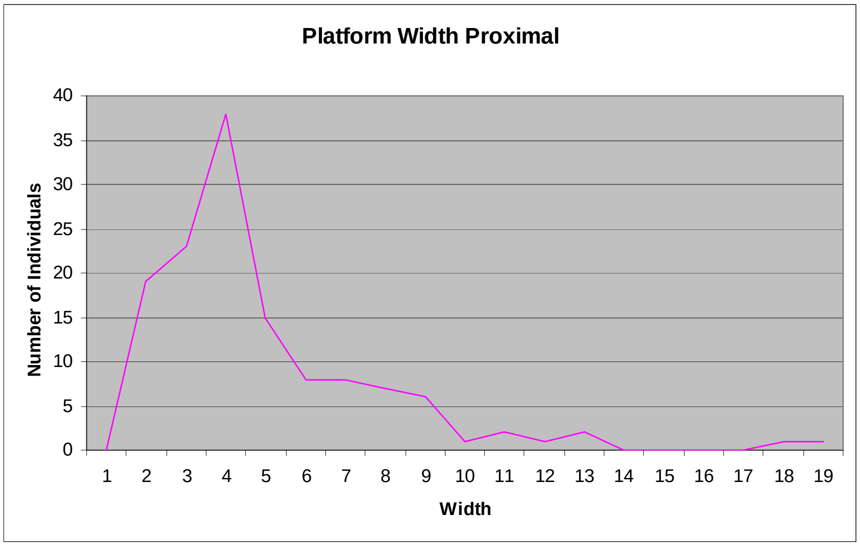

Chart 11-Platform width proximal flake

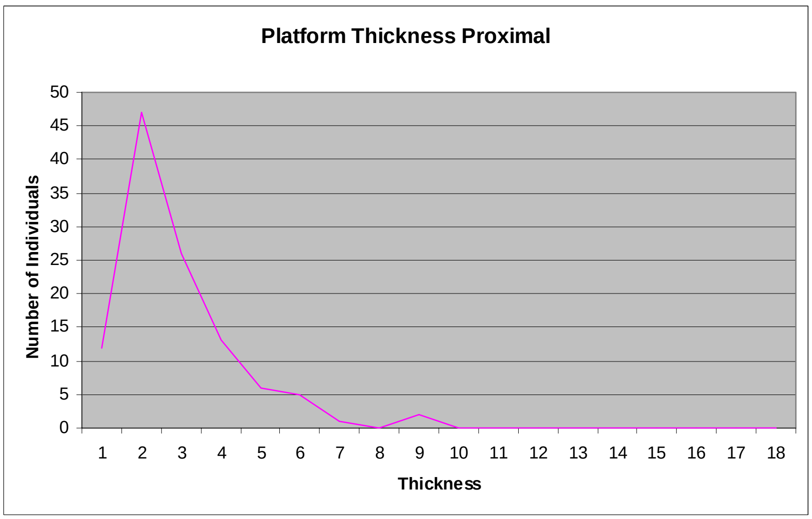

Chart 12-Platform thickness proximal flake

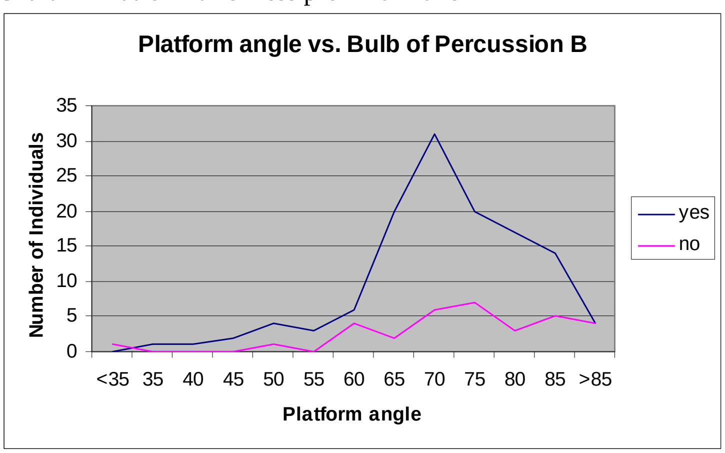

Chart 13-Striking platform angle vs. bulb of percussion B

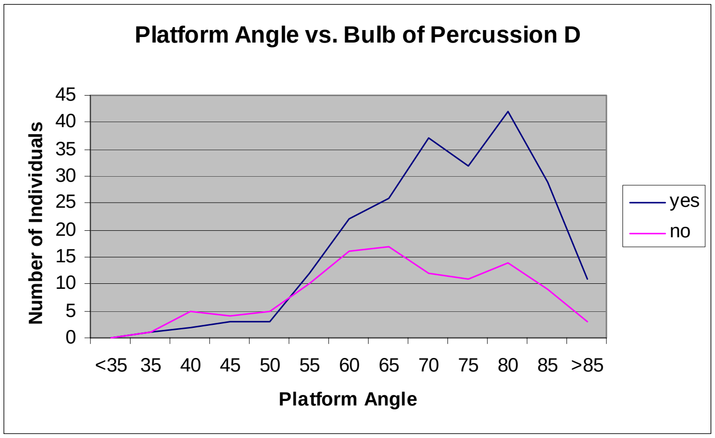

Chart 14-Striking platform angle vs. bulb of percussion D

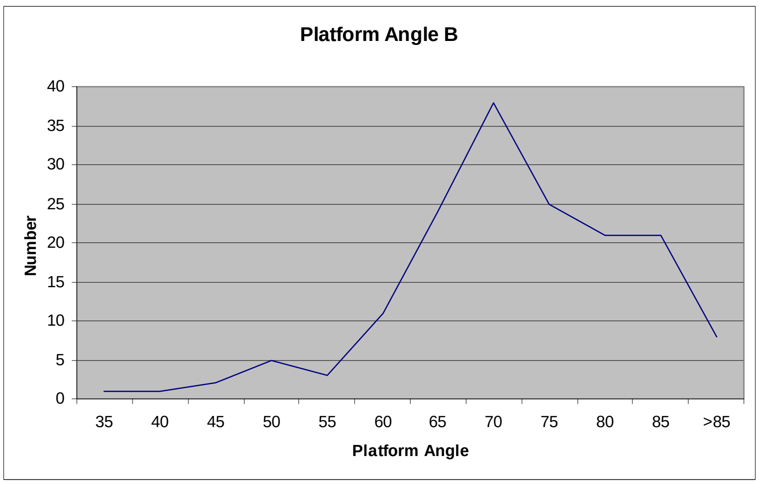

Chart 15-Striking platform angle B

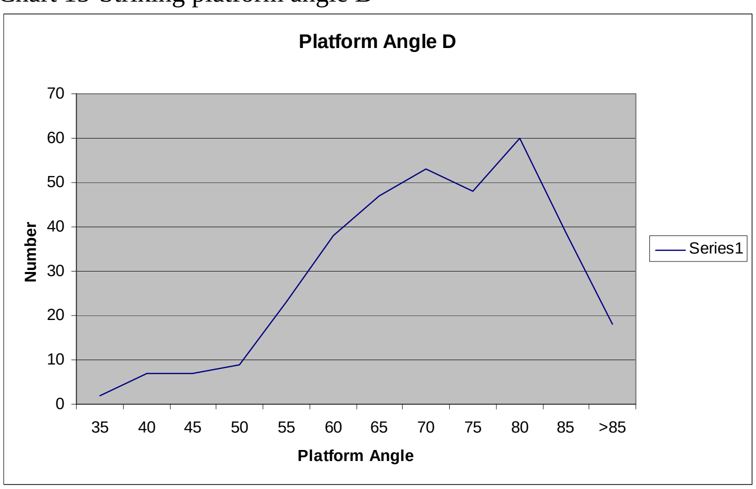

Chart 16-Striking platform angle D

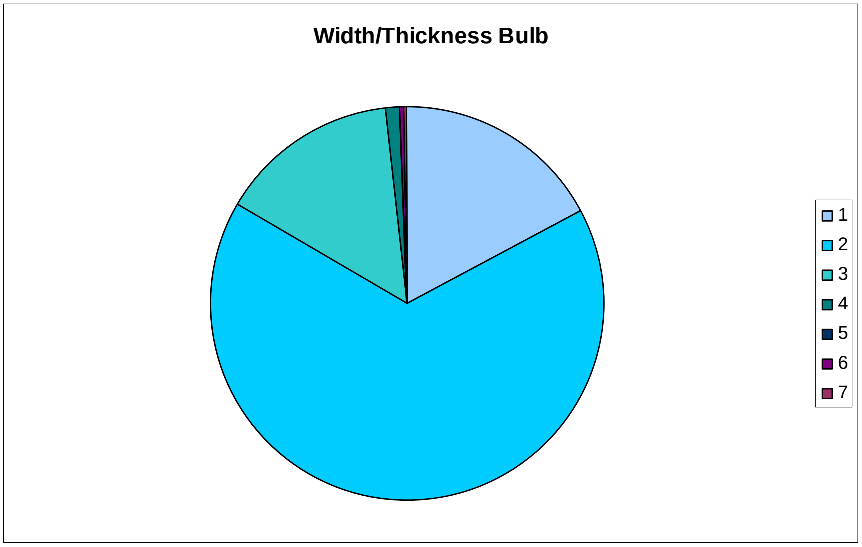

Chart 17- Width/thickness of Bulb of percussion

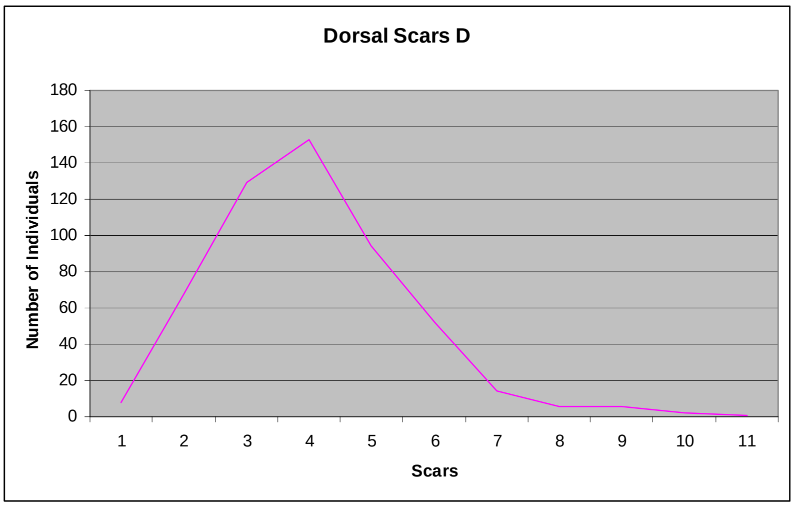

Chart 18-Dorsal scars D

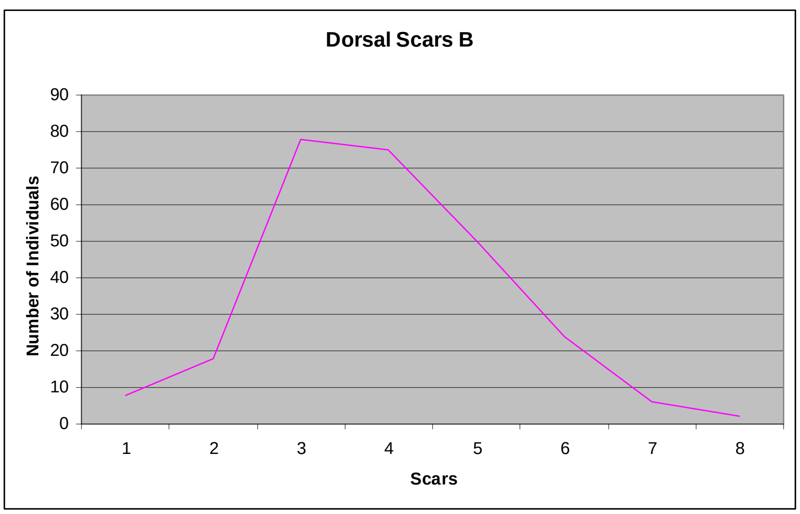

Chart 19-Dorsal scars B

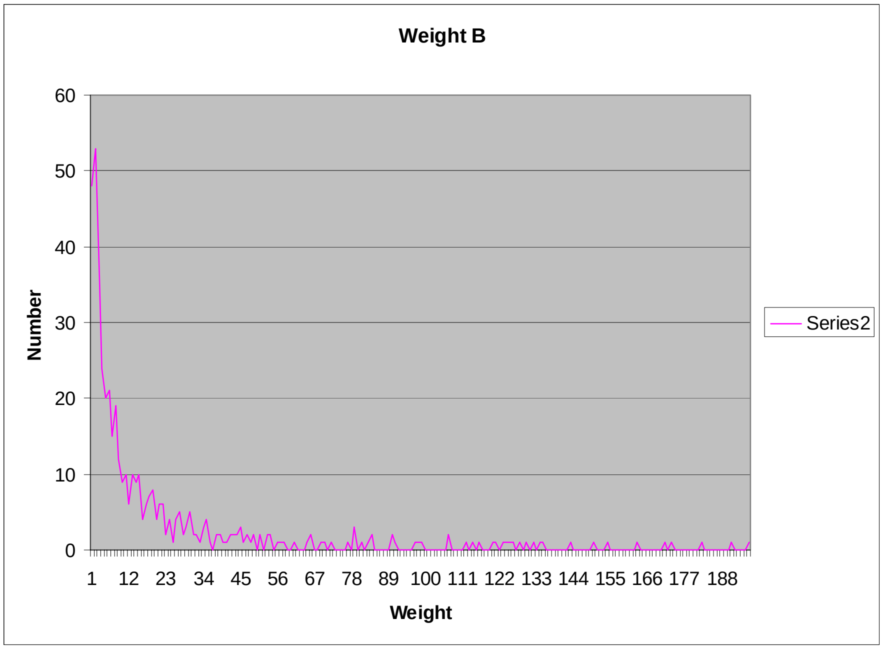

Chart 20-Weight field B

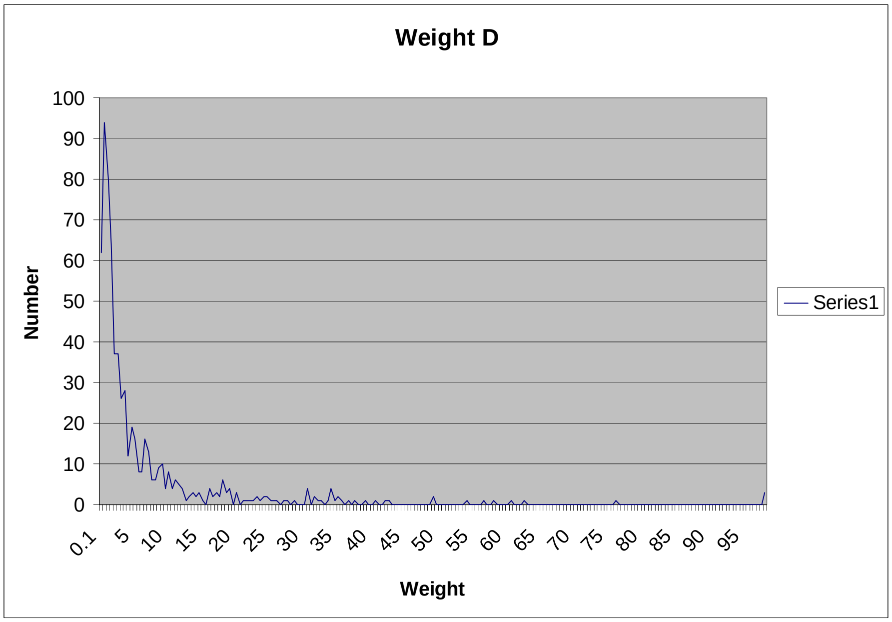

Chart 21-Weight field D

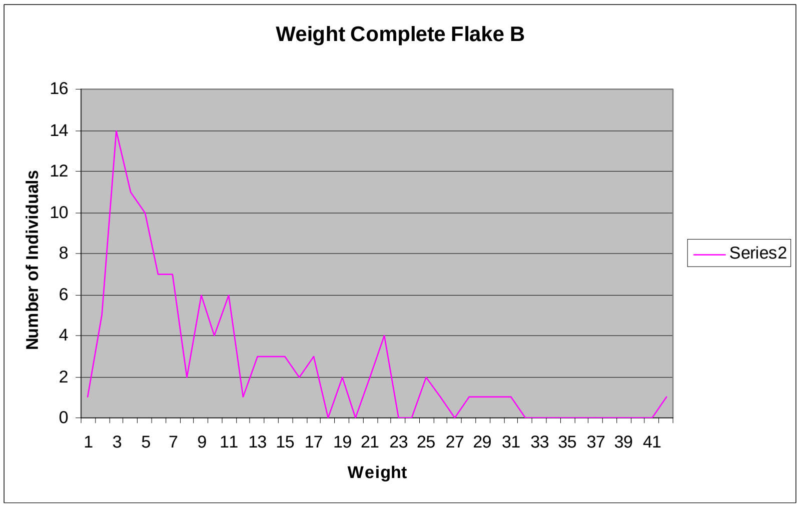

Chart 22-Weight complete flake B

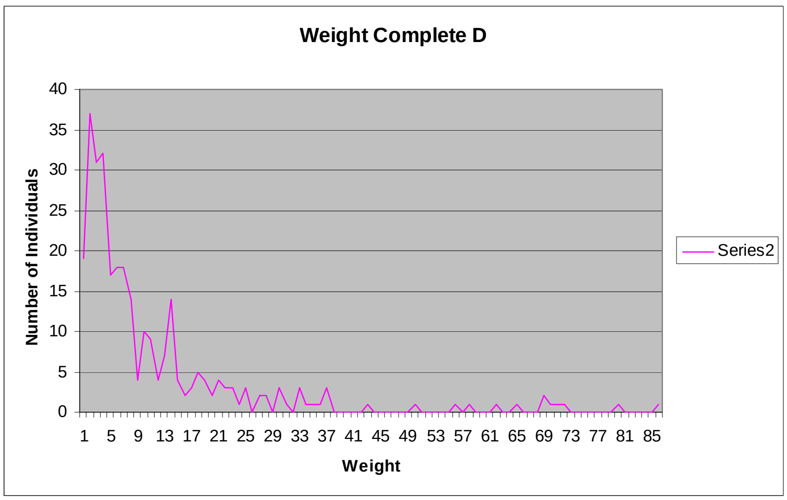

Chart 23-Weight complete flake D

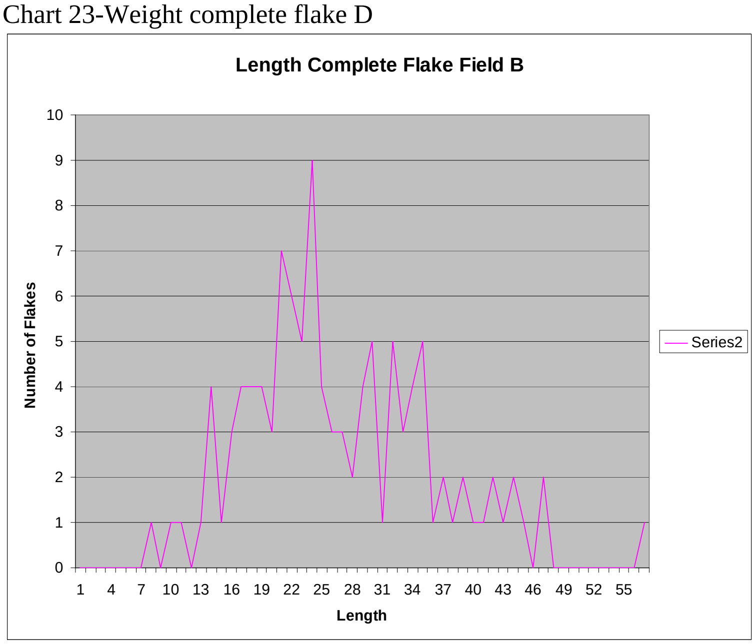

Chart 24-Length field B

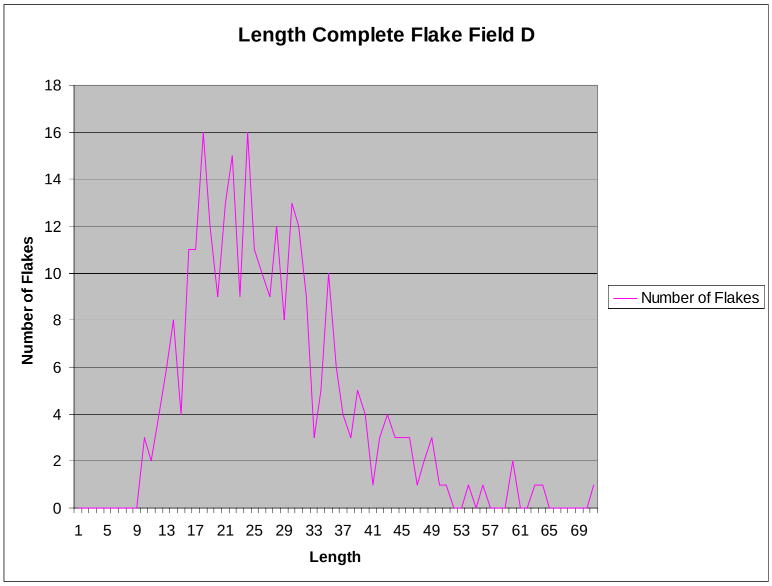

Chart 25-Length field D

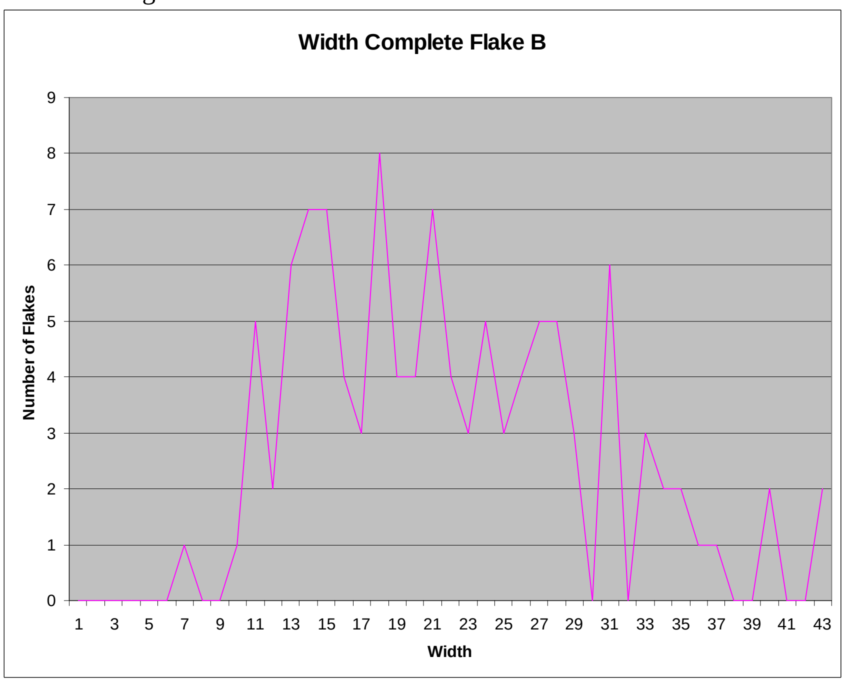

Chart 26-Width field B

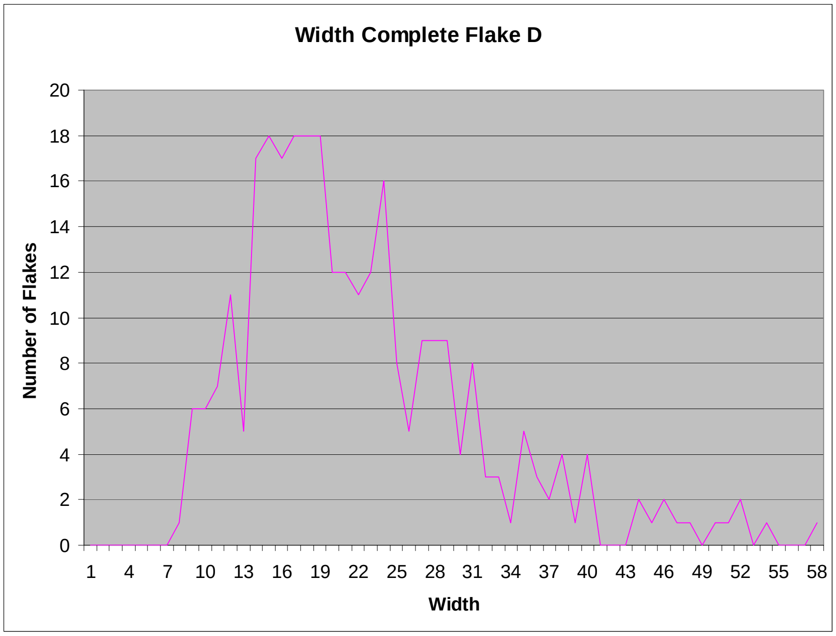

Chart 27-Width field D

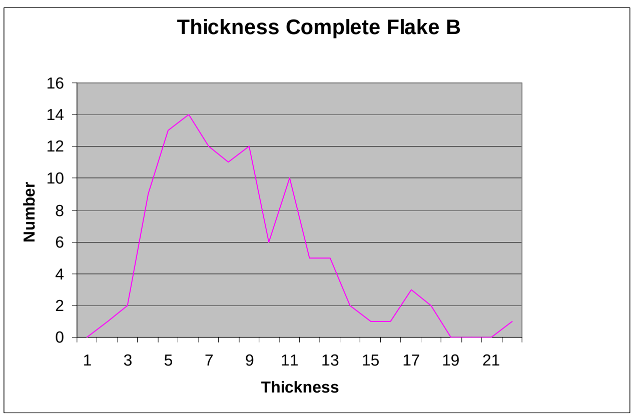

Chart 28-Thickness field B

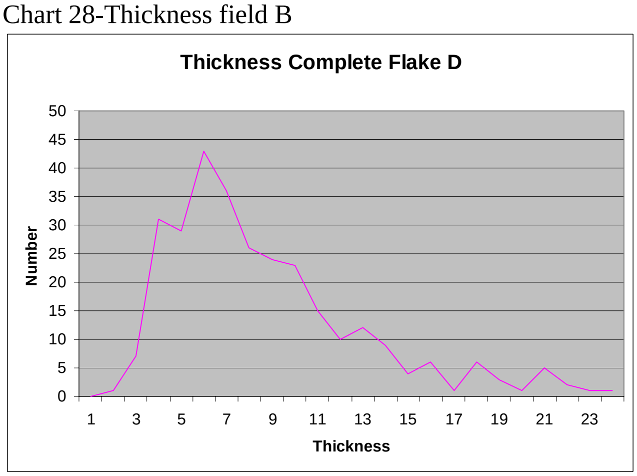

Chart 29-Thickness field D

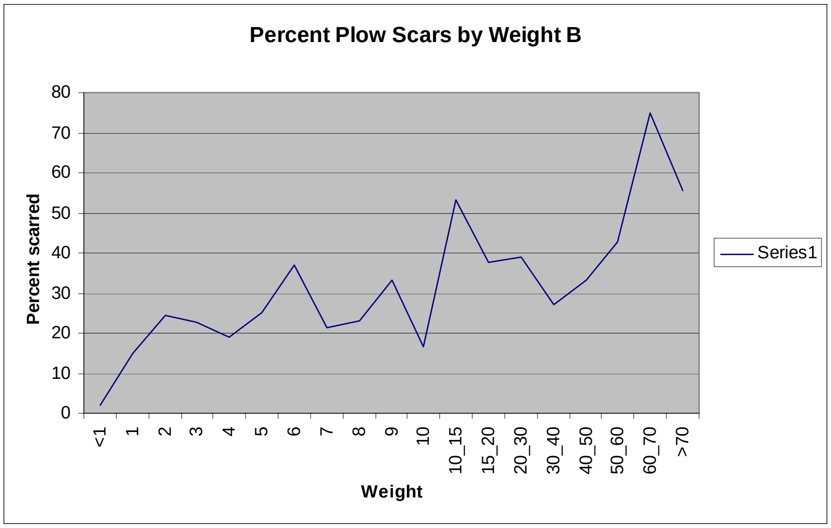

Chart 30-Percent plow damage by weight B

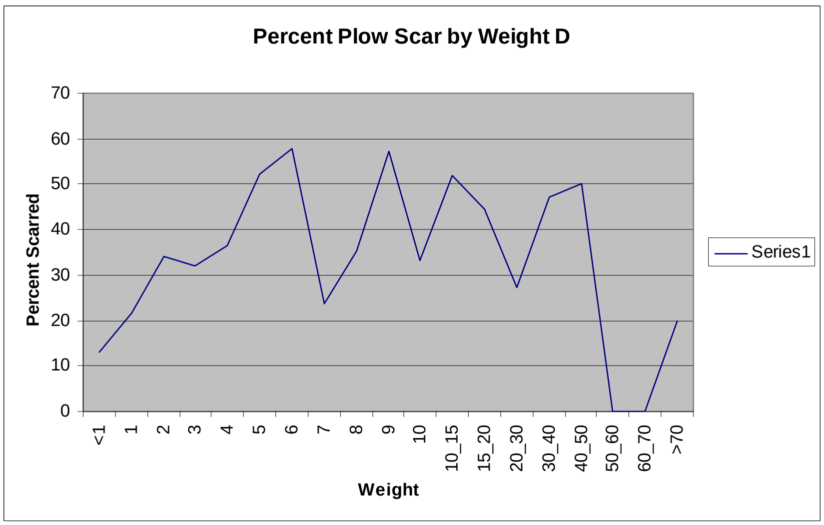

Chart 31-Percent plow damage by weight D

Appendix C- Tables

	Field B		Field D		Total	
Artifact type	N	%	N	%	N	%
Core	24	5	28	4	52	5
Uniface Blank	1	<1	0	0	1	<1
Uniface	2	<1	4	<1	6	<1
Uniface scraper	8	2	7	1	15	1
Biface Blank	23	5	48	7	71	6
Biface Preform	4	<1	3	<1	7	<1
Biface	0	0	3	<1	3	<1
Projectile Point	6	1	5	<1	11	1
Shatter	42	9	39	6	81	7
Complete Flake	110	24	297	43	407	36
Proximal Flake	60	13	60	9	120	10
Medial Flake	21	5	29	4	50	4
Distal Flake	62	14	124	18	186	16
Flake, indeterminate	2	<1	0	0	2	<1
Other Flake	11	2	23	3	34	3
Indeterminate	6	1	1	<1	7	<1
Fire crazed rock	0	0	2	<1	2	<1
Groundstone	1	<1	0	0	1	<1
Human tooth	1	<1	0	0	1	<1
Animal bone	0	0	2	<1	2	<1
Natural	72	16	12	2	84	7
Polished stone	1	<1	0	0	1	<1
Total	457	100	687	100	1144	100

Table 1 –artifact types and frequency